Computer Science and Engineering (Cyber Security)

CURRICULUM FROM SEMESTERS I TO VIII

Every course of B. Tech. Programme shall be placed in one of the nine categories as listed in table below.

Sl. No	Category	Code	Credits
1	Humanities and Social Sciences including Management courses	HMC	5
2	Basic Science courses	BSC	26
3	Engineering Science Courses	ESC	22
4	Program Core Courses	PCC	79
5	Program Elective Courses	PEC	15
6	Open Elective Courses	OEC	3
7	Project work and Seminar	PWS	10
8	Mandatory Non-credit Courses (P/F) with grade	MCN	--
9	Mandatory Student Activities (P/F)	MSA	2
	Total Mandatory Credits		**162**
10	Value Added Course (Optional)	VAC	20

No semester shall have more than five lecture-based courses and two laboratory and/or drawing/seminar/project courses in the curriculum. Semester-wise credit distribution shall be as below:

Sem	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Credits	17	21	22	22	23	23	15	17	160
Activity Points	50				50				---
Credits for Activity	2								2
G. Total									**162**

Basic Science Courses: Mathematics, Physics, Chemistry, Biology for Engineers, Life Science etc

Engineering Science Courses: Engineering Graphics, Programming in C, Basics of Electrical and Electronics Engineering, Basics of Civil and Mechanical Engineering,

Engineering Mechanics, Thermodynamics, Design Engineering, Materials Engineering, Workshops etc.

Humanities and Social Sciences including Management courses: English, Humanities, Professional Ethics, Management, Finance & Accounting, Life Skills, Professional Communication, Economics etc

Mandatory Non-credit Courses: Environmental Science, Constitution of India/Essence of Indian Knowledge Tradition, Industrial Safety Engineering, Disaster Management etc.

Course Code and Course Number

Each course is denoted by a unique code consisting of three alphabets followed by three numerals like **CSL 201.** The first two letter code refers to the department offering the course. CS stands for course in Computer Science & Engineering, course code MA refers to a course in Mathematics, course code ES refers to a course in Engineering Science etc. Third letter stands for the nature of the course as indicated in the following table.

Code	Description
T	Theory based courses (other than lecture hours, these courses can have tutorial and practical hours, e.g., L-T-P structures 3-0-0, 3-1-2, 3-0-2 etc.)
L	Laboratory based courses (where performance is evaluated primarily on the basis of practical or laboratory work with LTP structures like 0-0-3, 1-0-3, 0-1-3 etc.)
N	Non-credit courses
D	Project based courses (Major-, Mini- Projects)
Q	Seminar courses

Course Number is a three digit number and the first digit refers to the Academic year in which the course is normally offered, i.e. 1, 2, 3, or 4 for the B. Tech. Programme of four year duration. Of the other two digits, the last digit identifies whether the course is offered normally in the odd (odd number), even (non-zero even number) or in both the semesters (zero). The middle number could be any digit. CSL 201 is a laboratory course offered in Computer Science and Engineering department for third semester, MAT 101 is a course in Mathematics offered in the first semester, EET 344 is a theory course in Electrical Engineering offered in the sixth semester, PHT 110 is a course in Physics offered both the first and second semesters, EST 102 is a course in Basic Engineering offered by one or many departments in the second semester. These course numbers are to be given in the curriculum and syllabi.

Departments

Each course is offered by a Department and their two-letter course prefix is given in Table 2

Table 2: Departments and their codes

SL No	Department	Course Prefix	SL No	Department	Course Prefix
1	Aeronautical Engineering	AO	23	Electronics and Communication Engineering	EC
2	Agriculture Engineering	AG	24	Electronics and Computer Engineering	ER
3	Applied Electronics and Instrumentation	AE	25	Electrical and Computer Engineering	EO
4	Artificial Intelligence	AI	26	Electrical and Electronics Engineering	EE
5	Artificial Intelligence and Data Science	AD	27	Food Technology	FT
6	Artificial Engineering and Machine Learning	AM	28	Humanities	HU
7	Automobile Engineering	AU	29	Industrial Engineering	IE
8	Biomedical Engineering	BM	30	Information Technology	IT
9	Biotechnology	BT	31	Instrumentation & Control	IC
10	Chemical Engineering	CH	32	Mandatory Courses	MC
11	Chemistry	CY	33	Mathematics	MA
12	Civil Engineering	CE	34	Mechanical Engineering	ME
13	Civil and Environmental Engineering	CN	35	Mechatronics	MR
14	Computer Science and Business Systems	CB	36	Metallurgy	MT
15	Computer Science and Design	CX	37	Mechanical (Auto)	MU
16	Computer Science and Engineering	CS	38	Mechanical (Prod)	MP
17	Computer Science and Engineering (Artificial Intelligence)	CA	39	Naval & Ship Building	SB
18	Computer Science and Engineering (Artificial Intelligence and Machine Learning)	CM	40	Physics	PH
19	Computer Science and Engineering (Data Science)	CD	41	Polymer Engineering	PO
20	Computer Science and Engineering (Cyber Security)	CC	42	Production Engineering	PE
21	Cyber Physical Systems	CP	43	Robotics and Automation	RA
22	Electronics & Biomedical	EB	44	Safety & Fire Engineering	FS

SEMESTER I

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	MAT 101	LINEAR ALGEBRA AND CALCULUS	3-1-0	4	4
B 1/2	PHT 100	ENGINEERING PHYSICS A	3-1-0	4	4
	CYT 100	ENGINEERING CHEMISTRY	3-1-0	4	4
C 1/2	EST 100	ENGINEERING MECHANICS	2-1-0	3	3
	EST 110	ENGINEERING GRAPHICS	2-0-2	4	3
D 1/2	EST 120	BASICS OF CIVIL & MECHANICAL ENGINEERING	4-0-0	4	4
	EST 130	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	4-0-0	4	4
E	HUN 101	LIFE SKILLS	2-0-2	4	--
S 1/2	PHL 120	ENGINEERING PHYSICS LAB	0-0-2	2	1
	CYL 120	ENGINEERING CHEMISTRY LAB	0-0-2	2	1
T 1/2	ESL 120	CIVIL & MECHANICAL WORKSHOP	0-0-2	2	1
	ESL 130	ELECTRICAL & ELECTRONICS WORKSHOP	0-0-2	2	1
TOTAL				**23/24**	**17**

SEMESTER II

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	MAT 102	VECTOR CALCULUS DIFFERENTIAL EQUATIONS AND TRANSFORMS	3-1-0	4	4
B 1/2	PHT 100	ENGINEERING PHYSICS A	3-1-0	4	4
	CYT 100	ENGINEERING CHEMISTRY	3-1-0	4	4
C 1/2	EST 100	ENGINEERING MECHANICS	2-1-0	3	3
	EST 110	ENGINEERING GRAPHICS	2-0-2	4	3
D 1/2	EST 120	BASICS OF CIVIL & MECHANICAL ENGINEERING	4-0-0	4	4
	EST 130	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	4-0-0	4	4
E	HUT 102	PROFESSIONAL COMMUNICATION	2-0-2	4	--
F	EST 102	PROGRAMMING IN C	2-1-2	5	4
S 1/2	PHL 120	ENGINEERING PHYSICS LAB	0-0-2	2	1
	CYL 120	ENGINEERING CHEMISTRY LAB	0-0-2	2	1
T 1/2	ESL 120	CIVIL & MECHANICAL WORKSHOP	0-0-2	2	1
	ESL 130	ELECTRICAL & ELECTRONICS WORKSHOP	0-0-2	2	1
TOTAL				**28/29**	**21**

NOTE:

1. Engineering Physics A and Engineering Chemistry shall be offered in both semesters. Institutions can advise students belonging to about 50% of the number of branches in the Institution to opt for Engineering Physics A in S1 and Engineering Chemistry in S2 & vice versa. Students opting for Engineering Physics A in a semester should attend Physics Lab in the same semester and students opting for Engineering Chemistry in one semester should attend Engineering Chemistry Lab in the same semester

2. Engineering Mechanics and Engineering Graphics shall be offered in both semesters. Institutions can advise students belonging to about 50% of the number of branches in the Institution to opt for Engineering Mechanics in S1 and Engineering Graphics in S2 & vice versa.

3. Basics of Civil & Mechanical Engineering and Basics of Electrical & Electronics Engineering shall be offered in both semesters. Basics of Civil & Mechanical Engineering contain equal weightage for Civil Engineering and Mechanical Engineering. Slot for the course is D with CIE marks of 25 each and ESE marks of 50 each. Students belonging to branches of AEI, EI, BME, ECE, EEE, ICE, CSE, IT, RA can choose this course in S1.

   Basics of Electrical & Electronics Engineering contain equal weightage for Electrical Engineering and Electronics Engineering. Slot for the course is D with CIE marks of 25 each and ESE marks of 50 each. Students belonging to AERO, AUTO, CE, FSE, IE, ME, MECHATRONICS, PE, METALLURGY, BT, BCE, CHEM, FT, POLY can
   choose this course in S1. Students having Basics of Civil & Mechanical Engineering in one semester should attend Civil & Mechanical Workshop in the same semester and students having Basics of Electrical & Electronics Engineering in a semester should attend Electrical & Electronics Workshop in the same semester.

4. LIFE SKILLS

   Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

5. PROFESSIONAL COMMUNICATION

   Objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs. Coverage: Listening, Barriers to listening, Steps to overcome them, Purposive listening

   practice, Use of technology in the professional world. Speaking, Fluency & accuracy in speech, Positive thinking, Improving self-expression, Tonal variations, Group discussion practice, Reading, Speed reading practice, Use of extensive readers, Analytical and critical reading practice, Writing Professional Correspondence, Formal and informal letters, Tone in formal writing, Introduction to reports. Study Skills, Use of dictionary, thesaurus etc., Importance of contents page, cover & back pages, Bibliography, Language Lab.

SEMESTER III

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	MAT 203	DISCRETE MATHEMATICAL STRUCTURES	3-1-0	4	4
B	CST 201	DATA STRUCTURES	3-1-0	4	4
C	CST 203	LOGIC SYSTEM DESIGN	3-1-0	4	4
D	CST 205	OBJECT ORIENTED PROGRAMMING USING JAVA	3-1-0	4	4
E (1/2)	EST 200	DESIGN & ENGINEERING	2-0-0	2	2
	HUT 200	PROFESSIONAL ETHICS	2-0-0	2	2
F	MCN 201	SUSTAINABLE ENGINEERING	2-0-0	2	--
S	CSL 201	DATA STRUCTURES LAB	0-0-3	3	2
T	CSL 203	OBJECT ORIENTED PROGRAMMING LAB (IN JAVA)	0-0-3	3	2
R/M	VAC	Remedial/Minor course	3-1-0	4	4
TOTAL				**26***	**22/26**

* Excluding Hours to be engaged for Remedial/Minor course.

SEMESTER IV

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	MAT 266	MATHEMATICAL FOUNDATIONS FOR SECURITY SYSTEMS	3-1-0	4	4
B	CST 202	COMPUTER ORGANISATION AND ARCHITECTURE	3-1-0	4	4
C	CST 204	DATABASE MANAGEMENT SYSTEMS	3-1-0	4	4
D	CST 206	OPERATING SYSTEMS	3-1-0	4	4
E (1/2)	EST 200	DESIGN & ENGINEERING	2-0-0	2	2
	HUT 200	PROFESSIONAL ETHICS	2-0-0	2	2
F	MCN 202	CONSTITUTION OF INDIA	2-0-0	2	--
S	CCL 202	SCRIPTING LANGUAGES FOR SECURITY	0-0-3	3	2
T	CCL 204	OS AND DBMS LAB	0-0-3	3	2
R/M/H	VAC	Remedial/Minor/Honours course	3-1-0	4	4
TOTAL				**26***	**22/26**

* Excluding Hours to be engaged for Remedial/Minor/Honours course.

NOTE:

1. Design & Engineering and Professional Ethics shall be offered in both S3 and S4. Institutions can advise students belonging to about 50% of the number of branches in the Institution to opt for Design & Engineering in S3 and Professional Ethics in S4 & vice versa.

2. *All Institutions should keep 4 hours exclusively for Remedial class/Minor course (Thursdays from 3 to 5 PM and Fridays from 2 to 4 PM). If a student does not opt for minor programme, he/she can be given remedial class.

SEMESTER V

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	CST 301	FORMAL LANGUAGES AND AUTOMATA THEORY	3-1-0	4	4
B	CST 303	COMPUTER NETWORKS	3-1-0	4	4
C	CCT 305	SYSTEMS & NETWORK SECURITY	3-1-0	4	4
D	CCT 307	APPLIED CRYPTOGRAPHY	3-1-0	4	4
E	CST 309	MANAGEMENT O F SOFTWARE SYSTEMS	3-0-0	3	3
F	MCN 301	DISASTER MANAGEMENT	2-0-0	2	--
S	CCL 331	CRYPTOGRAPHY LAB	0-0-4	4	2
T	CCL 333	SYSTEM & NETWORK SECURITY LAB	0-0-4	4	2
R/M/H	VAC	Remedial/Minor/Honours course*	2-0-0	4	4
TOTAL				**29***	**23/27**
* Excluding Hours to be engaged for Remedial/Minor/Honours course.					

NOTE:

1. *All Institutions should keep 4 hours exclusively for Remedial class/Minor/ Honours course (Tuesdays from 3 to 5 PM and Wednesdays from 3 to 5 PM). If a student does not opt for minor/honours programme, he/she can be given remedial class.

SEMESTER VI

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	CST 302	COMPILER DESIGN	3-1-0	4	4
B	CCT 304	CYBER FORENSICS	3-1-0	4	4
C	CST 306	ALGORITHM ANA LYSIS AND DESIGN	3-1-0	4	4
D	CST ---	PROGRAM ELECTIVE I	2-1-0	3	3
E	HUT 300	INDUSTRIAL ECONOMICS & FOREIGN TRADE	3-0-0	3	3
F	CCT 308	COMPREHENSIVE COURSE WORK	1-0-0	1	1
S	CCL 332	CYBER FORENSICS LAB	0-0-3	3	2
T	CCD 334	MINIPROJECT	0-0-3	3	2
R/M/H	VAC	Remedial/Minor/Honours course*	3-1-0	4	4
TOTAL				25*	**23/27**
* Excluding Hours to be engaged for Remedial/Minor/Honours course.					

Note:

Electives: This curriculum envisages to offer a learner an opportunity to earn proficiency in one of the four trending areas in Computer Science, namely Security in Big Data, Machine Learning, Computer Programming and Formal Methods in Software Engineering . Three courses each from the above areas are included through Elective Courses in different Elective Buckets. For example, a learner who is interested in the ***Security in Big Data*** area may opt to take the elective courses - ***Storage Management & Security*** from Elective-I in S6, ***Introduction to BigData Technology*** from Elective-II in S7 and ***Big Data Security*** from Elective-IV in S8. The Department may offer Elective Courses to enable students to utilize this opportunity, depending on the availability of faculty. The courses included from these areas under various Elective Buckets are shown in the table below.

Different Specializations introduced through various Elective Buckets				
Bucket	**Specialisation**	**Semester**		
		S6	**S7**	**S8**
1	Big Data and Security	STORAGE MANAGEMENT & SECURITY (E-I)	INTRODUCTION TO BIG DATA TECHNOLOGY (E-II)	BIG DATA SECURITY (E-IV)
2	Machine Learning	FOUNDATIONS OF M A C H I N E LEARNING (E-I)	M A C H I N E LEARNING (E-II)	DEEP LEARNING (E-III)
3	Computer Programming	PROGRAMMING IN R (E-I)	WEB PROGRAMMING (E-II)	PROGRAMMING PARADIGMS (E-III)
4	Formal Methods in Software Engineering	AUTOMATED VERIFICATION(E-I)	MODEL BASED SOFTWARE DEVELOPMENT(E-II)	SOFTWARE TESTING (E-V)

PROGRAM ELECTIVE I

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
D	CST 312	FOUNDATIONS OF MACHINE LEARNING	2-1-0	3	3
	CST 322	DATA ANALYTICS	2-1-0		
	CCT 332	STORAGE MANAGEMENT & SECURITY	2-1-0		
	CST 342	AUTOMATED VERIFICATION	2-1-0		
	CCT 352	MALWARE FORENSICS	2-1-0		
	AIT 362	PROGRAMMING IN R	2-1-0		
	CST 372	DATA AND COMPUTER COMMUNICATION	2-1-0		

COURSES TO BE CONSIDERED FOR COMPREHENSIVE COURSE WORK

i MATHEMATICAL FOUNDATIONS FOR SECURITY SYSTEMS
ii DATA STRUCTURES
iii OPERATING SYSTEMS
iv COMPUTER NETWORKS
v DATABASE MANAGEMENT SYSTEMS
vi APPLIED CRYPTOGRAPHY

NOTE:

1. *All Institutions should keep 4 hours exclusively for Remedial class/Minor/Honours course (Tuesdays from 3 to 5 PM and Wednesdays from 2 to 4 PM). If a student does not opt for minor/honours programme, he/she can be given remedial class.

2. Comprehensive Course Work: The comprehensive course work in the sixth semester of study shall have a written test of 50 marks. The written examination will be of objective type similar to the GATE examination and will be conducted by the University. Syllabus for comprehensive examination shall be prepared by the respective BoS choosing the above listed 6 core courses studied from semesters 3 to
5. The pass minimum for this course is 25. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed in the curriculum.

3. Mini project: It is introduced in the sixth semester with a specific objective to strengthen the understanding of student's fundamentals through effective application of theoretical concepts. Mini project can help to boost their skills and widen the horizon of their thinking. The ultimate aim of an engineering student is to resolve a problem by applying theoretical knowledge. Doing more projects increases problem- solving skills. Student Groups with 3 or 4 members should identify a topic of interest in consultation with Faculty/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be

demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight. The internal evaluation will be made based on the product, the report and a viva-voce examination, conducted internally by a 3 member committee appointed by Head of the Department comprising HoD or a senior faculty member, Mini Project coordinator for that program and project guide.

Total marks: 150 - CIE 75 marks and ESE 75

marks Split up for CIE

Attendance	10
Project Guide	15
Project Report	10
Evaluation by the Committee (will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, work knowledge and involvement)	40

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SEMESTER VII

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	CCT 401	ETHICAL HACKING	2-1-0	3	3
B	CCT ---	PROGRAM ELECTIVE II	2-1-0	3	3
C	CCT ---	OPEN ELECTIVE	2-1-0	3	3
D	MCN 401	INDUSTRIAL SAFETY ENGINEERING	2-1-0	3	---
S	CCL 411	ETHICAL HACKING LAB	0-0-3	3	2
T	CCQ 413	SEMINAR	0-0-3	3	2
U	CCD 415	PROJECT PHASE I	0-0-6	6	2
R/M/H	VAC	Remedial/Minor/Honours course*	3-1-0	4	4
TOTAL				**24***	**15/19**
* Excluding Hours to be engaged for Remedial/Minor/Honours course.					

PROGRAM ELECTIVE II

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
B	CST 413	MACHINE LEARNING	2-1-0	3	3
	CCT 423	INTRUTION DETECTION & PREVENTION SYSTEM	2-1-0		
	CCT 433	CLOUD COMPUTING & SECURITY	2-1-0		
	CCT 443	MODEL BASED SOFTWARE DEVELOPMENT			
	CST 453	INTRODUCTION TO BIG DATA TECHNOLOGY	2-1-0		
	CST 463	WEB PROGRAMMING	2-1-0		
	CST 473	NATURAL LANGUAGE PROCESSING	2-1-0		

OPEN ELECTIVE

The open elective is offered in semester 7. Each program should specify the courses (maximum 5) they would like to offer as electives for other programs. The courses listed below are offered by the Department of **COMPUTER SCIENCE & ENGINEERING** for students of other undergraduate branches except for students of Computer Science & Engineering and Information Technology departments offered in the colleges under KTU.

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
B	CST 415	INTRODUCTION TO MOBILE COMPUTING	2-1-0	3	3
	CST 425	INTRODUCTION TO DEEP LEARNING	2-1-0		
	CST 435	COMPUTER GRAPHICS	2-1-0		
	CST 445	iv PYTHON FOR ENGINEERS	2-1-0		
	CST 455	v OBJECT ORIENTED CONCEPTS	2-1-0		

NOTE :

1. *All Institutions should keep 4 hours exclusively for Remedial class/Minor/Honours course (Mondays from 10 to 12 and Wednesdays from 10 to 12 Noon). If a student does not opt for minor/honours programme, he/she can be given remedial class.

2. Seminar: To encourage and motivate the students to read and collect recent and reliable information from their area of interest confined to the relevant discipline from technical publications including peer reviewed journals, conference, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of faculty members comprising Academic coordinator for that program, seminar coordinator and seminar guide based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report.

   Total marks: 100, only CIE, minimum required to pass 50

Attendance	10
Seminar Diary	10
Guide	20
Report	20
Presentation	40

3. Project Phase I: The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies. The assignment to normally include:

   - Literature study/survey of published literature on the assigned topic
   - Formulation of objectives
   - Formulation of hypothesis/ design/ methodology
   - Formulation of work plan and task allocation.
   - Block level design documentation
   - Seeking project funds from various agencies
   - Preliminary Analysis/Modeling/Simulation/Experiment/ Design/Feasibility study
   - Preparation of Phase 1 report

   Total marks: 100, only CIE, minimum required to pass 50

Guide	30
Interim evaluation by the Evaluation committee	20
Final evaluation by the Evaluation committee	30
Phase – I Report (By Evaluation committee)	20

   The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor.

SEMESTER VIII

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	CCT 402	BIOMETRIC SECURITY	2-1-0	3	3
B	CCT ---	PROGRAM ELECTIVE III	2-1-0	3	3
C	CCT ---	PROGRAM ELECTIVE IV	2-1-0	3	3
D	CCT ---	PROGRAM ELECTIVE V	2-1-0	3	3
T	CCT 404	COMPREHENSIVE COURSE VIVA	1-0-0	1	1
U	CCD 416	PROJECT PHASE II	0-0-12	12	4
R/M/H	VAC	Remedial/Minor/Honours course	3-1-0	4	4
TOTAL				**25***	**17/21**
* Excluding Hours to be engaged for Remedial/Minor/Honours course.					

PROGRAM ELECTIVE III

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
B	CST414	DEEP LEARNING	2-1-0	3	3
	CST 424	PROGRAMMING PARADIGMS	2-1-0		
	CCT 434	STENOGRAPHY AND DIGITAL WATERMARKING	2-1-0		
	CST 444	SOFT COMPUTING	2-1-0		
	CST 454	FUZZY SET THEORY AND APPLICATIONS	2-1-0		
	CST 464	EMBEDDED SYSTEMS	2-1-0		
	CST 474	COMPUTER VISION	2-1-0		

PROGRAM ELECTIVE IV

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
C	CCT 416	CYBER LAW	2-1-0	3	3
	CST 426	CLIENT SERVER ARCHITECTURE	2-1-0		
	CST 436	PARALLEL COMPUTING	2-1-0		
	CST 446	DATA COMPRESSION TECHNIQUES	2-1-0		
	CCT 456	BIG DATA SECURITY	2-1-0		
	CST 466	DATA MINING	2-1-0		
	CST 476	MOBILE COMPUTING	2-1-0		

PROGRAM ELECTIVE V

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
D	CST 418	i HIGH PERFORMANCE COMPUTING	2-1-0	3	3
	CST 428	ii BLOCK CHAIN TECHNOLOGIES	2-1-0		
	CST 438	iii IMAGE PROCESSING TECHNIQUE	2-1-0		
	CST 448	iv INTERNET OF THINGS	2-1-0		
	CST 458	v SOFTWARE TESTING	2-1-0		
	CST 468	vi BIOINFORMATICS	2-1-0		
	CST 478	vii COMPUTATIONAL LINGUISTICS	2-1-0		

NOTE:

1. *All Institutions should keep 4 hours exclusively for Remedial class/Minor/Honours course (Mondays from 10 to 12 and Wednesdays from 10 to 12 PM). If a student does not opt for minor/honours programme, he/she can be given remedial class.
2. Comprehensive Viva Voce: The comprehensive viva voce in the eighth semester of study shall have a viva voce for 50 marks. The viva voce shall be conducted based on the core subjects studied from third to eighth semester. The viva voce will be conducted by the same three member committee assigned for final project phase II evaluation towards the end of the semesters. The pass minimum for this course is 25. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed in the curriculum. The mark will be treated as internal and should be uploaded along with internal marks of other courses.
3. **Project Phase II:** The objective of Project Work Phase II & Dissertation is to enable the student to extend further the investigative study taken up in Project Phase I, either fully theoretical/practical or involving both theoretical and practical work, under the mentoring of a Project Guide from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment shall normally include:

    - In depth study of the topic assigned in the light of the Report prepared in Phase I;
    - Review and finalization of the Approach to the Problem relating to the assigned topic;
    - Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
    - Final development of product/process, testing, results, conclusions and future directions;
    - Preparing a paper for Conference presentation/Publication in Journals, if possible;
    - Preparing a Dissertation in the standard format for being evaluated by the Department;
    - Final Presentation before the concerned evaluation committee

Total marks: 150, only CIE, minimum required to pass 75

Guide	30
Interim evaluation, 2 times in the semester by a committee	50
Quality of the report evaluated by the above committee	30

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor).

Final evaluation by the final evaluation committee	40

(The final evaluation committee comprises Project coordinator, expert from Industry/ research Institute and a senior faculty from a sister department. The same committee will conduct Comprehensive for 50 marks).

MINOR

Minor is an additional credential a student may earn if she/he does 20 credits worth of additional learning in a discipline other than her/his major discipline of B.Tech. degree. The objective is to permit a student to customize their Engineering degree to suit their specific interests. Upon completion of an Engineering Minor, a student will be better equipped to perform interdisciplinary research and will be better employable. Engineering Minors allow a student to gain interdisciplinary experience and exposure to concepts and perspectives that may not be a part of their major degree programs.

The academic units offering minors in their discipline will prescribe the set of courses and/or other activities like projects necessary for earning a minor in that discipline. A specialist bucket of 3-6 courses is identified for each Minor. Each bucket may rest on one or more foundation courses. A bucket may have sequences within it, i.e., advanced courses may rest on basic courses in the bucket. She/he accumulates credits by registering for the required courses, and if the requirements for a particular minor are met within the time limit for the course, the minor will be awarded. This will be mentioned in the Degree Certificate as "Bachelor of Technology in xxx with Minor in yyy". The fact will also be reflected in the consolidated grade card, along with the list of courses taken. If one specified course cannot be earned during the course of the programme, that minor will not be awarded. The individual course credits earned, however, will be reflected in the consolidated grade card.

(i) The curriculum/syllabus committee/BoS shall prepare syllabus for courses to be included in the curriculum from third to eight semesters for all branches. The minor courses shall be identified by M slot courses.

(ii) Registration is permitted for Minor at the beginning of third semester. Total credits required to award B. Tech with Minor is 182 (162 + 20)

(iii) Out of the 20 Credits, 12 credits shall be earned by undergoing a minimum of three courses, of which one course shall be a mini project based on the chosen area. They can do Mini project either in S7 or in S8. The remaining 8 credits could be acquired through 2 MOOCs recommended by the Board of Studies and approved by the Academic Council or 2 courses from the minor buckets listed here. The classes for Minor shall be conducted along with regular classes and no extra time shall be required for conducting the courses.

(iv) There won't be any supplementary examination for the courses chosen for Minor.

(v) On completion of the program, "Bachelor of Technology in xxx with Minor in yyy" will be awarded if the registrant earn 20 credits form the minorcourses.

(vi) The registration for minor program will commence from semester 3 and all the academic units offering minors in their discipline should prescribe set of such courses. The courses shall be grouped into maximum of 5 buckets. The bucket of courses may have sequences within it, i.e., advanced courses may rest on basic courses in the bucket. Reshuffling of courses between various buckets will not be allowed. There is option to skip any two courses listed here and to opt for equivalent MOOC courses approved by the Academic Council. In any case, they should carry out a mini project based on the chosen area in S7 or S8. For example: Students who have registered **for B.Tech Minor**

in Computer Science & Engineering (Cyber Security) can opt to study the courses listed below:

HONOURS

Honours is an additional credential a student may earn if she/he opts for the extra 20 credits needed for this in her/his own discipline. Honours is not indicative of a class. The University is providing this option for academically extra brilliant students to acquire Honours. Honours is intended for a student to *gain expertise*/get *specialized* in an area inside his/her major B.Tech discipline and to enrich knowledge in emerging/advanced areas in the concerned branch of engineering. It is particularly suited for students aiming to pursue higher studies. Upon completion of Honours, a student will be better equipped to perform research in her/his branch of engineering. On successful accumulation of credits at the end of the programme, this will be mentioned in the Degree Certificate as "Bachelor of Technology in xxx, with Honours." The fact will also be reflected in the consolidated grade card, along with the list of courses taken. If a student is not earning credits for any one of the specified course for getting Honours, she/he is not entitled to get Honours. The individual course credits earned, however, will be reflected in the consolidated grade card.

The courses shall be grouped into maximum of 3 buckets, each bucket representing a particular specialization in the branch. The students shall select only the courses from same bucket in all semesters. It means that the specialization is to be fixed by the student and cannot be changed subsequently. The internal evaluation, examination and grading shall be exactly as for other mandatory courses. The Honours courses shall be identified by H slot courses.

(i) The curriculum/syllabus committee/BoS shall prepare syllabus for courses to be included in the curriculum from fourth to eight semesters for all branches. The Honours courses shall be identified by H slot courses.

(ii) Registration is permitted for Honours at the beginning of fourth semester. Total credits required is 182 (162 + 20).

(iii) Out of the 20 Credits, 12 credits shall be earned by undergoing a minimum of three courses, of which one course shall be a mini project based on the chosen area. The remaining 8 credits could be acquired through 2 MOOCs recommended by the Board of studies and approved by the Academic Council or 2 courses from the same bucket as the above 3 courses. The classes for Honours shall be conducted along with regular classes and no extra time shall be required for conducting the courses. The students should earn a grade of 'C' or better for all courses under Honours.

(iv) There won't be any supplementary examination for the courses chosen for Honours.

(v) On successful accumulation of credits at the end of the programme, "Bachelor of Technology in xxx, with Honours" will be awarded if overall CGPA is greater than

or equal to 8.5, earned a grade of 'C' or better for all courses chosen for Honours and there is no history of 'F' Grade in the entire span of the BTech Course.

(vi) The registration for Honours program will commence from semester 4 and the all academic units offering Honours in their discipline should prescribe set of such courses. The courses shall be grouped into maximum of 5 buckets, each bucket representing a particular specialization in the branch. The students shall select only the courses from same bucket in all semesters. It means that the specialization is to be fixed by the student and cannot be changed subsequently. There is option to skip any two courses listed here if required, and to opt for equivalent MOOC courses approved by the Academic Council. In any case, they should carry out a mini project based on the chosen area in S8. For example: Students who have registered for **B.Tech in Computer Science and Engineering(Cyber Security) with Honours** can opt to study the courses listed in one of the buckets shown below:

HONOURS BUCKETS												
SEMESTER	**BUCKET-1**				**BUCKET-2**				**BUCKET-3**			
	Specialization - **Security in Network Applications**				Specialization **Machine Learning**				Specialization – **Computer Vision**			
	COURSE NO	**COURSE NAME**	**HOURS**	**CREDIT**	**COURSE NO**	**COURSE NAME**	**HOURS**	**CREDIT**	**COURSE NO**	**COURSE NAME**	**HOURS**	**CREDIT**
S4	CCT 292	SECURE MOBILE APPLICATION DEVELOPMENT	4	4	CST 294	COMPUTATIONAL FUNDAMENTALS FOR MACHINE LEARNING	4	4	AIT 296	ADVANCED TOPICS IN COMPUTER GRAPHICS	4	4
S5	CCT 393	WEB APPLICATION SECURITY	4	4	CST 395	NEURAL NETWORKS AND DEEP LEARNING	4	4	AIT 397	ADVANCED CONCEPTS IN COMPUTER VISION	4	4
S6	CCT 394	WIRELESS AND EMAIL SECURITY	4	4	CST 396	ADVANCED TOPICS IN MACHINE LEARNING	4	4	AIT 398	IMAGE AND VIDEO PROCESSING	4	4
S7	CCT 495	BLOCKCHAIN AND CRYPTO-CURRENCY	4	4	CST 497	REINFORCEMENT LEARN-ING	4	4	AIT 499	SURVEILLANCE VIDEO ANALYTICS	4	4
S8	CCD 496	MINI PROJECT	4	4	CCD 496	MINI PROJECT	4	4	CCD 496	MINI PROJECT	4	4
Note: Name of the specialization shall be mentioned in the Honours Degree to be awarded												

INDUCTION PROGRAM

There will be three weeks induction program for first semester students. It is a unique three-week immersion Foundation Programme designed specifically for the fresher's which includes a wide range of activities right from workshops, lectures and seminars to sports tournaments, social works and much more. The programme is designed to mould students into well-rounded individuals, aware and sensitized to local and global conditions and foster their creativity, inculcate values and ethics, and help students to discover their passion. Foundation Programme also serves as a platform for the fresher's to interact with their batch- mates and seniors and start working as a team with them. The program is structured around the following five themes:

The programme is designed keeping in mind the following objectives:

- **Values and Ethics**: Focus on fostering a strong sense of ethical judgment and moral fortitude.
- **Creativity**: Provide channels to exhibit and develop individual creativity by expressing themselves through art, craft, music, singing, media, dramatics, and other creative activities.
- **Leadership, Communication and Teamwork**: Develop a culture of teamwork and group communication.
- **Social Awareness**: Nurture a deeper understanding of the local and global world and our place in at as concerned citizens of the world.
- **Physical Activities & Sports**: Engage students in sports and physical activity to ensure healthy physical and mental growth.

SEMESTER I

MAT 101	LINEAR ALGEBRA AND CALCULUS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: This course introduces students to some basic mathematical ideas and tools which are at the core of any engineering course. A brief course in Linear Algebra familiarises students with some basic techniques in matrix theory which are essential for analysing linear systems. The calculus of functions of one or more variables taught in this course are useful in modelling and analysing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

Prerequisite: A basic course in one-variable calculus and matrix theory**.**

Course Outcomes: After the completion of the course the student will be able to

CO 1	solve systems of linear equations, diagonalize matrices and characterise quadratic forms
CO 2	compute the partial and total derivatives and maxima and minima of multivariable functions
CO 3	compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas
CO 4	perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent
CO 5	determine the Taylor and Fourier series expansion of functions and learn their applications.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	1			1	2		2
CO 2	3	3	3	3	2	1			1	2		2
CO 3	3	3	3	3	2	1			1	2		2
CO 4	3	2	3	2	1	1			1	2		2
CO 5	3	3	3	3	2	1			1	2		2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

Assignments: Assignment should include specific problems highlighting the applications of the methods introduced in this course in science and engineering.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1): Solve systems of linear equations, diagonalize matrices and characterise quadratic forms

1. A is a real matrix of order $3 \times 3$and $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$. What can you say about the solution of $AX = 0$if rank of A is 1? 2 ?3?
2. Given$A = \begin{bmatrix} 3 & 0 & 2 \\ 0 & 2 & 0 \\ -2 & 0 & 0 \end{bmatrix}$, find an orthogonal matrix Pthat diagonalizes A.
3. Find out what type of conic section the following quadratic form represents

$$17x^2 - 30x_1x_2 + 17x_2^2 = 128$$

4. The matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$has an eigen value5 with corresponding Eigen vector$X = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$. Find A^5X

Course Outcome 2 (CO2): compute the partial and total derivatives and maxima and minima of multivariable functions

1. Find the slope of the surface $z = x^2y + 5y^3$in the x-direction at the point (1,-2)

2. Given the function $w = xy + z$, use chain rule to find the instantaneous rate of change of $w$at each point along the curve $x = cost, y = sint, z = t$

3. Determine the dimension of rectangular box open at the top , having a volume 32 cubic ft and requiring the least amount of material for it's construction.

Course Outcome 3(CO3): compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas.

1. Evaluate $\iint_D (x + 2y)\, DA$where D is the region bounded by the parabolas $y = 2x^2$and $y = 1 + x^2$

2. Explain how you would find the volume under the surface $z = f(x, y)$and over a specific region Din the xyplane using (i) double integral (ii) triple integral?

3. Find the mass and centre of gravity of a triangular lamina with vertices (0,0), (2,1), (0,3) if the density function is $f(x, y) = x + y$

4. Use spherical coordinates to evaluate $\iiint_B (x^2 + y^2 + z^2)^3\, dV$where B is the unit ball defined by $B = \{(x, y, z): x^2 + y^2 + z^2 \leq 1\}$

Course Outcome 4 (CO4): perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent.

1. What is the difference between a sequence and a series and when do you say that they are convergent? Divergent?

2. Determine whether the series $\sum_{n=1}^{n=\infty} \frac{5}{2n^2+4n+3}$converges or diverges.

3. Is the series $\sum_{n=1}^{n=\infty} \frac{(-1)^{n-1}}{n}$convergent? Absolutely convergent? Conditionally convergent?

Course Outcome 5 (CO5): determine the Taylor and Fourier series expansion of functions and learn their applications.

1. Assuming the possibility of expansion find the Maclaurin series expansion of

   $f(x) = (1 + x)^k$for$|x| < 1$where $k$is any real number. What happens if $k$is a positive integer?

2. Use Maclaurin series of $ln(1 + x), -1 < x \leq 1$to find an approximate value of$ln2$.

3. Find the Fourier series of the function$f(x) = x^2, -2 \leq x < 2, f(x + 4) = f(x)$. Hence using Parseval's identity prove that $1 + \frac{1}{2^4} + \frac{1}{3^4} + \ \ldots \ = \frac{\pi^4}{90}$

4. Expand the function $f(x) = x\ (0 < x < 1/2)$ into a (i) Fourier sine series (ii) Fourier cosine series.

Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: **MAT 101**

Max. Marks: 100 **Duration: 3 Hours**

LINEAR ALGEBRA AND CALCULUs

(2019-Scheme)

(Common to all branches)

PART A

(Answer **all** questions, **each** question carries 3 marks)

1. Determine the rank of the matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ -2 & -4 & 2 \\ 3 & 6 & -3 \end{bmatrix}$.
2. Write down the eigen values of $= \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$. What are the eigen values of $P^{-1}AP$ where $P = \begin{bmatrix} -4 & 2 \\ 3 & -1 \end{bmatrix}$?
3. Find $f_x(1,3)$ and $f_y(1,3)$ for the function $f(x,y) = 2x^3y^2 + 2y + 4x$.
4. Show that the function $u(x,t) = \sin(x - ct)$ is a solution of the equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$.
5. Use double integral to find the area of the region enclosed between the parabolas $y = \frac{1}{2}x^2$ and the line $y = 2x$.
6. Use polar coordinates to evaluate the area of the region bounded by $x^2 + y^2 = 4$, the line $y = x$ and the y axis in the first quadrant
7. Test the convergence of the series $\sum_{k=1}^{\infty} \frac{k}{k+1}$.
8. Test the convergence of the alternating series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{1}{k}$ using Leibnitz test.
9. Find the Taylor series expansion of $sin\pi x$ about $x = \frac{1}{2}$.
10. Find the values to which the Fourier series of

$f(x) = x$ for $-\pi < x < \pi$, with $f(x + 2\pi) = f(x)$ converges (10x3=30)

PART B

(Answer **one full** question from each module, each question carries **14** marks)

Module -I

11. (a) Solve the following system of equations

$$y + z - 2w = 0$$
$$2x - 3y - 3z + 6w = 2$$
$$4x + y + z - 2w = 4$$

(b) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$

12. (a) Diagonalize the matrix $\begin{bmatrix} -1 & 2 & -2 \\ 2 & 4 & 1 \\ 2 & 1 & 4 \end{bmatrix}$

(b) What kind of conic section the quadratic form $3x_1^2 + 22x_1x_2 + 3x_2^2 = 0$ represents? Transform it to principal axes.

Module - II

13. (a) Find the local linear approximation to $f(x, y) = \sqrt{x^2 + y^2}$ at the point $(3, 4)$.Use it to approximate $f(3.04,3.98)$

(b) Let $w = \sqrt{x^2 + y^2 + z^2}$, $x = cos\theta, y = sin\theta, z = tan\theta$. Use chain rule to find $\frac{dw}{d\theta}$when $\theta = \frac{\pi}{4}$.

14. (a) Let $z = f(x, y)$ where $x = rcos\theta, y = rsin\theta,$ prove that $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial z}{\partial \theta}\right)^2$.

(b) Locate all relative maxima, relative minima and saddle points $f(x, y) = xy + \frac{a^3}{x} + \frac{b^3}{y}(a \neq 0, b \neq 0)$.

Module - III

15. (a) Evaluate $\iint_D (2x^2y + 9y^3)\, dxdy$ where D is the region bounded by $y = \frac{2}{3}x$ and $y = 2\sqrt{x}$

(b) Evaluate $\int_0^4 \int_{\sqrt{y}}^2 e^{x^3}\, dxdy$ changing the order of integration.

16. (a) Find the volume of the solid bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$..

(b) Evaluate $\iiint \sqrt{1 - x^2 - y^2 - z^2}\, dxdydz$, taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$, by transforming to spherical polar coordinates

Module - IV

17. (a) Test the convergence of the series

(i) $\sum_{k=1}^{\infty} \frac{k^k}{k!}$ (ii) $\sum_{k=2}^{\infty} \left(\frac{4k-5}{2k+1}\right)^k$

(b) Determine the convergence or divergence of the series $\sum_{k=1}^{\infty} (-1)^k \frac{(2k-1)!}{3^k}$

18. (a) Check whether the series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{(2k)!}{(3k-2)!}$is absolutely convergent, conditionally convergent or divergent.

(b) Test the convergence of the series $1+\frac{1.2}{1.3}+\frac{1.2.3}{1.3.5}+\frac{1.2.3.4}{1.3.5.7}+\cdots$

Module - V

19. (a) Obtain the Fourier series of for $f(x)=e^{-x}$, in the interval $0<x<2\pi$.with $f(x+2\pi)=f(x)$. Hence deduce the value of $\sum_{n=2}^{\infty}\frac{(-1)^n}{1+n^2}$.

    (b) Find the half range sine series of $f(x)=\begin{cases}\frac{2kL}{x} & if\ 0<x<\frac{L}{2}\\ \frac{2k(L-x)}{L} & if\ \frac{L}{2}<x<L\end{cases}$

20. (a)Expand $(1+x)^{-2}$.as a Taylor series about $x=0$and state the region of convergence of the series.

(b) Find the Fourier series for $f(x)=x^2$ in the interval $-\pi<x<\pi$

with $f(x+2\pi)=f(x)$.Hence show that $\frac{1}{1^4}+\frac{1}{2^4}+\frac{1}{3^4}+\cdots=\frac{\pi^4}{90}$. (14X5=70)

Syllabus

Module 1 (Linear algebra)

(Text 2: Relevant topics from sections 7.3, 7.4, 7.5, 8.1,8.3,8.4)

Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix, fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof), Eigen values and eigen vectors. Diagonaliztion of matrices, orthogonal transformation, quadratic forms and their canonical forms.

Module 2 (multivariable calculus-Differentiation)

(Text 1: Relevant topics from sections 13.3, 13.4, 13.5, 13.8)

Concept of limit and continuity of functions of two variables, partial derivatives, Differentials, Local Linear approximations, chain rule, total derivative, Relative maxima and minima, Absolute maxima and minima on closed and bounded set.

Module 3(multivariable calculus-Integration)

(Text 1: Relevant topics from sections 14.1, 14.2, 14.3, 14.5, 14.6, 14.8)

Double integrals (Cartesian), reversing the order of integration, Change of coordinates (Cartesian to polar), finding areas and volume using double integrals, mass and centre of gravity of inhomogeneous laminas using double integral. Triple integrals, volume calculated as triple integral, triple integral in cylindrical and spherical coordinates (computations involving spheres, cylinders).

Module 4 (sequences and series)

(Text 1: Relevant topics from sections 9.1, 9.3, 9.4, 9.5, 9.6)

Convergence of sequences and series, convergence of geometric series and p-series(without proof), test of convergence (comparison, ratio and root tests without proof); Alternating series and Leibnitz test, absolute and conditional convergence.

Module 5 (Series representation of functions)

(Text 1: Relevant topics from sections 9.8, 9.9. Text 2: Relevant topics from sections 11.1, 11.2, 11.6)

Taylor series (without proof, assuming the possibility of power series expansion in appropriate domains), Binomial series and series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence); Fourier series, Euler formulas, Convergence of Fourier series (without proof), half range sine and cosine series, Parseval's theorem (without proof).

Text Books

1. H. Anton, I. Biven,S.Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition, John Wiley & Sons, 2016.

Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson, Reprint, 2002.
3. Peter V. O'Neil, Advanced Engineering Mathematics , Cengage, 7th Edition, 2012
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Linear Algebra (10 hours)**	
1.1	Systems of linear equations, Solution by Gauss elimination	1
1.2	Row echelon form, finding rank from row echelon form, fundamental theorem for linear systems	3
1.3	Eigen values and eigen vectors	2
1.4	Diagonaliztion of matrices, orthogonal transformation, quadratic forms	4

	and their canonical forms.	
2	**Multivariable calculus-Differentiation (8 hours)**	
2.1	Concept of limit and continuity of functions of two variables, partial derivatives	2
2.2	Differentials, Local Linear approximations	2
2.3	Chain rule, total derivative	2
2.4	Maxima and minima	2
3	**Multivariable calculus-Integration (10 hours)**	
3.1	Double integrals (Cartesian)-evaluation	2
3.2	Change of order of integration in double integrals, change of coordinates (Cartesian to polar),	2
3.3	Finding areas and volumes, mass and centre of gravity of plane laminas	3
3.4	Triple integrals	3
4	**Sequences and series (8 hours)**	
4.1	Convergence of sequences and series, geometric and p-series	2
4.2	Test of convergence(comparison, ratio and root)	4
4.3	Alternating series and Leibnitz test, absolute and conditional convergence	2
5	**Series representation of functions (9 hours)**	
5.1	Taylor series, Binomial series and series representation of exponential, trigonometric, logarithmic functions;	3
5.2	Fourier series, Euler formulas, Convergence of Fourier series(Dirichlet's conditions)	3
5.3	Half range sine and cosine series, Parseval's theorem.	3

PHT 100	ENGINEERING PHYSICS A (FOR CIRCUIT BRANCHES)	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics Program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Classify the properties of magnetic materials and apply vector calculus to static magnetic fields and use Maxwell's equations to diverse engineering problems
CO 5	Analyze the principles behind various superconducting applications, explain the working of solid state lighting devices and fibre optic communication system

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3	1						1	2			1
CO 5	3	1						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20

Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.

   (b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.

   (b) A liquid of refractive index μ is introduced between the lens and glass plate.

What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function ?

2. What are excitons ?

3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.

(b) Calculate the first three energy values of an electron in a one dimensional box of width 1 A^0 in electron volt.

Course Outcome 4 (CO4):

1. Compare displacement current and conduction current.

2. Mention any four properties of ferro magnetic materials.

3. (a) Starting from Maxwell's equations, derive the free space electromagnetic wave equation and show that velocity of electromagnetic wave is $1/ (\mu_o \varepsilon_o)^{½}$

(b) An electromagnetic wave is described by $E = 100 \exp 8\pi i [10^{14} t – (10^6 z / 3)]$ V/m. Find the direction of propagation of the wave,speed of the wave and magnetic flux density in the wave.

Course Outcome 5 (CO5):

1. Explain the working of a solar cell.

2. Distinguish between Type I and Type II super conductors.

3. (a) Define numerical aperture and derive an expression for it.

(b) Explain the working of intensity modulated fibre optic sensor.

Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: PHT 100

Course Name: Engineering Physics A

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators
2. Distinguish between longitudinal and transverse waves
3. Write a short note on antireflection coating.
4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.
5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.
6. Explain surface to volume ratio of nanomaterials.
7. State Faraday's laws of electromagnetic induction.
8. Compare displacement current and conduction current
9. List four important applications of superconductors.
10. Give the working principle of LED. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution.Discuss the cases of over damped, critically damped and under damped cases. (10)

(b) The frequency of a tuning fork is 500 Hz and its Q factor is $7\times10^{4.}$ Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value.(4)

12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by y =0.00327 sin (72.1x-2.72t)m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv)Velocity of the wave. (4)

Module 2

13.(a)Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid. (10)

(b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength 4800Å. Given β = 0.0555 cm. (4)

14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)

(b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15.(a) Derive time dependent and independent Schrodinger equations. (10)

(b) An electron is confined to one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16.(a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)

(b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17.(a) State Poynting's Theorem. Calculate the value of Poynting vector at the surface of the sun if the power radiated by the sun is 3.8×10^{26} W and its radius is 7×10^{8} m. (5)

(b) Distinguish between paramagnetic, diamagnetic and ferromagnetic materials. (9)

18.(a) Starting from Maxwell's Equations, derive electromagnetic wave equations in free space. (10)

(b) If the magnitude of **H** in a plane wave is 1 A/m, find the magnitude of **E** in free space. (4)

Module 5

19.(a) Show that superconductors are perfect diamagnets. Distinguish between Type I and Type II superconductors with suitable examples. (10)

(b) Write a short note on high temperature superconductors. (4)

20.(a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33. (4) (14x5=70)

Syllabus

ENGINEERING PHYSICS A
(FOR CIRCUIT BRANCHES)

Module 1

Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2

Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3

Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4

Magnetism & Electro Magnetic Theory

Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux, Magnetic permeability and susceptibility, Classification of magnetic materials-para, dia and ferromagnetic materials

Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem, Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)

Module 5

Superconductivity & Photonics

Superconducting phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II, BCS Theory (Qualitative), High temperature superconductors-Applications of super conductivity

Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics, Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors.

Text Books

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition 2019

2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition 2017

Reference Books

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007
7. Halliday, Resnick, Walker, "Fundamentals of Physics'', John Wiley & Sons.Inc, 2001
8. David J Griffiths, "Introduction to Electrodynamics'', Addison-Wesley publishing, 3rd Edition, 1999
9. Premlet B., "Advanced Engineering Physics", Phasor Books,10th edition,2017
10. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Oscillations and Waves (9 hours)**	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves. Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	**Wave Optics (9 hours)**	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hr
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	**Quantum Mechanics &Nanotechnology (9hours)**	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	**Magnetism & Electro Magnetic Theory (9 hours)**	
4.1	Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux	2 hrs

	density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux	
4.2	Explanation for Magnetic permeability and susceptibility Classification of magnetic materials- para, dia and ferromagnetic materials	1 hr
4.3	Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem	2 hrs
4.4	Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)	4 hrs
5	**Superconductivity &Photonics (9hours)**	
5.1	Super conducting Phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II	2 hrs
5.2	BCS Theory (Qualitative), High temperature superconductors, Applications of super conductivity	2 hrs
5.3	Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics	2 hrs
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

PHT 110	ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)	Category	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Apply the knowledge of ultrasonics in non-destructive testing and use the principles of acoustics to explain the nature and characterization of acoustic design and to provide a safe and healthy environment
CO 5	Apply the comprehended knowledge about laser and fibre optic communication systems in various engineering applications

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3							1	2			1
CO 5	3	2						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50

Apply	10	10	20
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE MARKS	ESE MARKS	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.
   (b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.
   (b) A liquid of refractive index μ is introduced between the lens and glass plate. What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function?

2. What are excitons ?

3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.

(b) Calculate the first three energy values of an electron in a one dimensional box of width 1 A^0 in electron volt.

Course Outcome 4 (CO4):

1. Explain reverberation and reverberation time.
2. How ultrasonic waves are used in non-destructive testing.
3. (a) With a neat diagram explain how ultrasonic waves are produced by a piezoelectric oscillator.

(b) Calculate frequency of ultrasonic waves that can be produced by a nickel rod of length 4 cm. (Young's Modulus = 207 G Pa, Density = 8900 Kg /m^3)

Course Outcome 5 (CO 5):

1. Distinguish between spontaneous emission and stimulated emission.
2. Explain optical resonators.
3. (a) Explain the construction and working of Ruby Laser.

(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33.

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Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: PHT 110

Course Name: Engineering Physics B

Max.Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators.

2. Distinguish between longitudinal and transverse waves.

3. Write a short note on antireflection coating.

4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.

5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.

6. Explain surface to volume ratio of nanomaterials.

7. Define sound intensity level. Give the values of threshold of hearing and threshold of pain.

8. Describe the method of non-destructive testing using ultra sonic waves

9. Explain the condition of population inversion

10. Distinguish between step index and graded index fibre. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution. Discuss the cases of over damped, critically damped and under damped cases. (10)

(b) The frequency of a tuning fork is 500 Hz and its Q factor is $7\times10^{4.}$ Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value. (4)

12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by y =0.00327 sin (72.1x-2.72t) m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv) Velocity of the wave. (4)

Module 2

13. (a) Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid? (10)

(b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength 4800Å. Given $\beta = 0.0555$ cm. (4)

14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)

(b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15. (a) Derive time dependent and independent Schrodinger equations. (10)

(b) An electron is confined to one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16. (a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)

(b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17. (a) Explain reverberation and reverberation time? What is the significance of Reverberation time. Explain the factors affecting the acoustics of a building and their corrective measures? (10)

(b) The volume of a hall is 3000 m^3. It has a total absorption of 100m^2 sabine. If the hall is filled with audience who add another 80 m^2sabine, then find the difference in reverberation time. (4)

18. (a) With a neat diagram explain how ultrasonic waves are produced by piezoelectric oscillator. Also discuss the piezoelectric method of detection of ultrasonic waves. (10)

(b) An ultrasonic source of 0.09 MHz sends down a pulse towards the sea bed which returns after 0.55 sec. The velocity of sound in sea water is 1800 m/s. Calculate the depth of the sea and the wavelength of the pulse. (4)

Module 5

19. (a) Outline the construction and working of Ruby laser. (8)

(b) What is the principle of holography? How is a hologram recorded? (6)

20. (a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) An optical fibre made with core of refractive index 1.5 and cladding with a fractional index difference of 0.0006. Find refractive index of cladding and numerical aperture. (4)

(14x5=70)

SYLLABUS

ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)

Module 1

Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2

Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3

Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening Mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4

Acoustics & Ultrasonics

Acoustics, Classification of sound-Musical sound-Noise, Characteristics of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation), Factors affecting architectural acoustics and their remedies

Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator –Working, Detection of ultrasonic waves - Thermal and Piezoelectric

methods, Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid , Applications of ultrasonic waves -SONAR,NDT and Medical

Module 5

Laser and Fibre optics

Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle, Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) ,Applications of laser, Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications

Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors

Text Books

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition, 2019.

2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition, 2017.

Reference Books

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007
7. B. B. Laud, "Lasers and Non linear optics", New age International Publishers, 2nd Edition ,2005
8. Premlet B., "Advanced Engineering Physics", Phasor Books,10th edition ,2017
9. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Oscillations and Waves (9 hours)**	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	**Wave Optics (9 hours)**	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hrs
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	**Quantum Mechanics &Nanotechnology (9hours)**	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	**Acoustics & Ultrasonics (9hrs)**	
4.1	Acoustics, Classification of sound-Musical sound-Noise, Characteristics	3 hrs

	of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation)	
4.2	Factors affecting architectural acoustics and their remedies	1 hr
4.3	Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator – Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods	3hrs
4.4	Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid ,Applications of ultrasonic waves -SONAR,NDT and Medical.	2 hr
5	**Laser and Fibre optics (9hours)**	
5.1	Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle	2 hrs
5.2	Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) Applications of laser	3 hrs
5.3	Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications	1 hr
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

CYT 100	ENGINEERING CHEMISTRY	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like spectroscopy, electrochemistry, instrumental methods etc. Also familiarize the students with topics like mechanism of corrosion, corrosion prevention methods, SEM, stereochemistry, polymers, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of chemistry.

Prerequisite: Concepts of chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Apply the basic concepts of electrochemistry and corrosion to explore its possible applications in various engineering fields.
CO 2	Understand various spectroscopic techniques like UV-Visible, IR, NMR and its applications.
CO 3	Apply the knowledge of analytical method for characterizing a chemical mixture or a compound. Understand the basic concept of SEM for surface characterisation of nanomaterials.
CO 4	Learn about the basics of stereochemistry and its application. Apply the knowledge of conducting polymers and advanced polymers in engineering.
CO 5	Study various types of water treatment methods to develop skills for treating wastewater.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1									
CO 2	1	1		1	2							
CO 3	1	1		1	2							
CO 4	2	1										
CO 5	1			1			3					

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			
Create			

End Semester Examination Pattern: There will be two parts- **Part A** and **Part B. Part A** contains **10** questions (**2** questions from each module), having **3** marks for each question. Students should answer **all** questions. **Part B** contains **2** questions from each module, of which student should answer any one. Each question can have maximum **2** subdivisions and carries **14** marks.

Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. What is calomel electrode? Give the reduction reaction (3 Marks)

2. List three important advantages of potentiometric titration (3 Marks)

3. (a) Explain how electroless plating copper and nickel are carried out (10 Marks)

(b) Calculate the emf of the following cell at 30°C, Z n / Zn^{2+} (0.1M) // Ag^{+} (0.01M) // Ag.

Given E^0 Zn^{2+}/Zn = -0.76 V, E^0 Ag^{+}/Ag = 0.8 V. (4 Marks)

Course Outcome 2 (CO 2)

1. State Beer Lambert's law (3 Marks)

2. List the important applications of IR spectroscopy (3 Marks)

3. (a) What is Chemical shift? What are factors affecting Chemical shift? How ^1H NMR spectrum of CH_3COCH_2Cl interpreted using the concept of chemical shift. (10 Marks)

(b) Calculate the force constant of HF molecule, if it shows IR absorption at 4138 cm^{-1}. Given that atomic masses of hydrogen and fluorine are 1u and 19u respectively. (4 Marks)

Course Outcome 3 (CO 3):

1. Distinguish between TGA and DTA (3 Marks)

2. Give two differences between GSC and GLC (3 Marks)

3. (a) Explain the principle, instrumentation and procedure of HPLC (10 Marks)

(b) Interpret TGA of $CaC_2O_4 . H_2O$ (4 Marks)

Course Outcome 4 (CO 4):

1. Explain the geometrical isomerism in double bonds (3 Marks)

2. What are the rules of assigning R-S notation? (3 Marks)

3. (a) What are conducting polymers? How it is classified? Give the preparation of polyaniline (10 Marks)

(b) Draw the stereoisomers possible for CH_3-$(CHOH)_2$-COOH (4 Marks)

Course Outcome 5 (CO 5):

1. What is degree of hardness? (3 Marks)

2. Define BOD and COD (3 Marks)

3. (a) Explain the EDTA estimation of hardness (10 Marks)

(b) Standard hard water contains 20 g of CaCO3 per liter,50 mL of this required 30mL of EDTA solution, 50mL of sample water required 20mL of EDTA solution. 50mL sample water after boiling required 14 mL EDTA solution. Calculate the temporary hardness of the given sample of water, in terms of ppm. (4 Marks)

MODEL QUESTION PAPER

Total Pages:

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER B.TECH DEGREE EXAMINATION

Course Code: CYT100,

Course Name: ENGINEERING CHEMISTRY

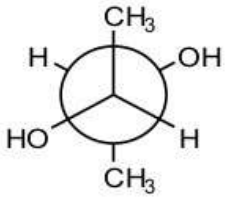
Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks Marks

1	What is potentiometric titration? How the end point is determined graphically?	(3)
2	What is Galvanic series? How is it different from electrochemical series?	(3)
3	Which of the following molecules can give IR absorption? Give reason? (a) O_2 (b) H_2O (c) N_2 (d) HCl	(3)
4	Which of the following molecules show UV-Visible absorption? Give reason. (a) Ethane (b) Butadiene (c) Benzene	(3)

5		What are the visualization techniques used in TLC?	(3)
6		Write the three important applications of nanomaterials.	(3)
7		Draw the Fischer projection formula and find R-S notation of	(3)



8		Write the structure of a) Polypyrroleb) Kevlar.	(3
9		What is break point chlorination?	(3)
10		What is reverse osmosis?	(3)

PART B

Answer any one full question from each module, each question carries 14 marks

Module 1

11	a)	Give the construction of Li-ion cell. Give the reactions that take place at the electrodes during charging and discharging. What happens to anodic material when the cell is 100% charged.	(10)
	b)	Calculate the standard electrode potential of Cu, if its electrode potential at 25 °C is 0.296 V and the concentration of Cu^{2+} is 0.015 M.	(4)

OR

12	a)	Explain the mechanism of electrochemical corrosion of iron in oxygen rich and oxygen deficient acidic and basic environments.	(10)
	b)	Given below are reduction potentials of some species	(4)

$MnO_4^- + 8H^+ + 5e \rightarrow Mn^{2+} + 4H_2O$; $E^0 = +1.51$ V

$Cl_2 + 2e \rightarrow 2Cl^-$; $E^0 = +1.36$ V

$S_2O_8^{2-} + 2e \rightarrow 2SO_4^{2-}$; $E^0 = +1.98$ V

Use the above data to examine whether the acids, dil. HCl and dil. H_2SO_4 , can be used to provide acid medium in redox titrations involving $KMnO_4$.

Module 2

13	a)	What is spin-spin splitting? Draw the NMR spectrum of (i) CH_3 CH_2CH_2 Br (ii) $CH_3CH(Br)CH_3$ Explain how NMR spectrum can be used to identify the two isomers.	(10)
	b)	A dye solution of concentration 0.08M shows absorbance of 0.012 at 600 nm; while a test solution of same dye shows absorbance of 0.084 under same conditions. Find the concentration of the test solution.	(4)

OR

14	a)	Explain the basic principle of UV-Visible spectroscopy. What are the possible electronic transitions? Explain with examples.	(10)
	b)	Sketch the vibrational modes of CO_2 and H_2O. Which of them are IR active?	(4)

Module 3

15	a)	Explain the principle, instrumentation and procedure involved in gas chromatography.	(10)
	b)	Explain the DTA of $CaC_2O_4.H_2O$ with a neat sketch.	(4)
		OR	
16	a)	Explain the various chemical methods used for the synthesis of nanomaterial	(10)
	b)	How TGA is used to analyse the thermal stability of polymers?	(4)

Module 4

17	a)	What are conformers? Draw the*cis* and *trans*isomers of 1, 3-dimethylcylohexane. Which conformer (chair form) is more stable in each case?	(10)
	b)	What is ABS? Give properties and applications.	(4)
		OR	
18	a)	Explain the various structural isomers with suitable example.	(10)
	b)	What is OLED? Draw a labelled diagram.	(4)

Module 5

19	a)	What are ion exchange resins? Explain ion exchange process for removal of hardness of water? How exhausted resins are regenerated?	(10)
	b)	50 mL sewage water is diluted to 2000 mL with dilution water; the initial dissolved oxygen was 7.7 ppm. The dissolved oxygen level after 5 days of incubation was 2.4 ppm. Find the BOD of the sewage.	(4)
		OR	
20	a)	What are the different steps in sewage treatment? Give the flow diagram. Explain the working of trickling filter.	(10)
	b)	Calculate the temporary and permanent hardness of a water sample which contains $[Ca^{2+}]$ = 160 mg/L, $[Mg^{2+}]$ = 192 mg/L and $[HCO_3^-]$ = 122 mg/L.	(4)

Syllabus

Module 1

Electrochemistry and Corrosion

Introduction - Differences between electrolytic and electrochemical cells - Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes - SHE - Calomel electrode - Glass Electrode - Construction and Working. Single electrode potential - definition - Helmholtz electrical double layer -Determination of E^0 using calomel electrode.Determination of pH using glass electrode.Electrochemical series and its applications. Free energy and EMF - Nernst Equation - Derivation - single electrode and cell (Numericals) -Application - Variation of emf with temperature. Potentiometric titration - Introduction -Redox titration only.Lithiumion cell - construction and working.Conductivity- Measurement of conductivity of a solution (Numericals).

Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.

Module 2

Spectroscopic Techniques and Applications

Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications. ^{1}H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).

Module 3

Instrumental Methods and Nanomaterials

Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$. Chromatographic methods - Basic principles and applications of column and TLC-Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.

Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).

Module 4

Stereochemistry and Polymer Chemistry

Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations). R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.

Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications.Kevlar-preparation, properties and applications.Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.

Module 5

Water Chemistry and Sewage Water Treatment

Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of

hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. Municipal water treatment (brief) - Disinfection methods - chlorination, ozone andUV irradiation.

Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals). Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.

Text Books

1. B. L. Tembe, Kamaluddin, M. S. Krishnan, "Engineering Chemistry (NPTEL Web-book)", 2018.

2. P. W. Atkins, "Physical Chemistry", Oxford University Press, 10th edn., 2014.

Reference Books

1. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw-Hill, 4thedn., 1995.
2. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
3. B. R. Puri, L. R. Sharma, M. S. Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 47th Edition, 2017.
4. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7th Edition, 2005.
5. Ernest L. Eliel, Samuel H. Wilen, "Stereo-chemistry of Organic Compounds", WILEY, 2008.
6. Raymond B. Seymour, Charles E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc; 4th Revised Edition, 1996.
7. MuhammedArif, Annette Fernandez, Kavitha P. Nair "Engineering Chemistry", Owl Books, 2019.
8. Ahad J., "Engineering Chemistry", Jai Publication, 2019.
9. Roy K. Varghese, "Engineering Chemistry", Crownplus Publishers, 2019.
10. Soney C. George,RinoLaly Jose, "Text Book of Engineering Chemistry", S. Chand & Company Pvt Ltd, 2019.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures (hrs)
1	**Electrochemistry and Corrosion**	**9**
1.1	Introduction - Differences between electrolytic and electrochemical cells- Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes- SHE - Calomel electrode - Glass Electrode - Construction and Working.	**2**
1.2	Single electrode potential – definition - Helmholtz electrical double layer - Determination of E^0 using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF - Nernst Equation – Derivation - single electrode and cell (Numericals) -Application -Variation of emf with temperature.	**3**
1.3	Potentiometric titration - Introduction -Redox titration only. Lithiumion cell - construction and working. Conductivity- Measurement of conductivity of a solution (Numericals).	**2**
1.4	Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.	**2**
2	**Spectroscopic Techniques and Applications**	**9**
2.1	Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals).	**2**
2.2	UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.	**2**
2.3	IR-Spectroscopy – Principle - Number of vibrational modes -Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications.	**2**
2.4	^{1}H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).	**3**
3	**Instrumental Methods and Nanomaterials**	**9**
3.1	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$.	**2**

3.2	Chromatographic methods - Basic principles and applications of column and TLC-Retention factor.	**2**
3.3	GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.	**2**
3.4	Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).	**3**
4	**Stereochemistry and Polymer Chemistry**	**9**
4.1	Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations).	**2**
4.2	R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.	**1**
4.3	Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.	**2**
4.4	Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.	**4**
5	**Water Chemistry and Sewage Water Treatment**	**9**
5.1	Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	**3**
5.2	Municipal water treatment (brief) - Disinfection methods - chlorination, ozone andUV irradiation.	**2**
5.3	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals).	**2**
5.4	Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process.	**2**

EST 100	ENGINEERING MECHANICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	1	0	3	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while stationary or in motion. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to:

CO 1	Recall principles and theorems related to rigid body mechanics
CO 2	Identify and describe the components of system of forces acting on the rigid body
CO 3	Apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	Choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	Solve problems involving rigid bodies, applying the properties of distributed areas and masses

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	15
Understand	10	10	15
Apply	30	30	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Part A

Course Outcome 1 (CO1): (One question from each module to meet the course objective 1: *To recall principles and theorems related to rigid body mechanics***)**

1. Explain D'Alembert's principle

2. Distinguish static and dynamic friction

3. State and explain perpendicular axis theorem

Course Outcome 2 (CO2) (One question from each module to meet the course objective 2: *To identify and describe the components of system of forces acting on the rigid body***)**

1. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.

2. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar

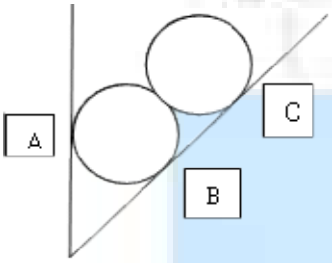
3. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

Part B

All the questions under this section shall assess the learning levels corresponding to the course outcomes listed below.

CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses

1. Two rollers each of weight 100 N are supported by an inclined plane and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth.

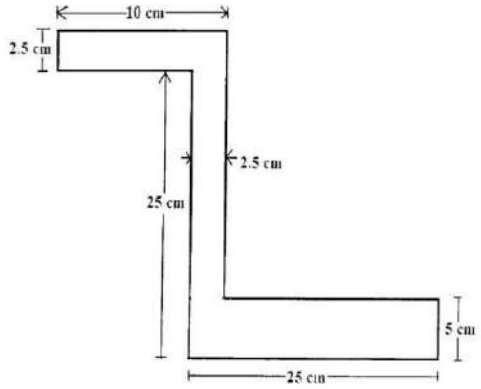


Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent equilibrium state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

2. A cylindrical disc, 50 cm diameter and cm thickness, is in contact with a horizontal conveyor belts running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s. Also compute the moment acting about the axis of the disc in both cases.

Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

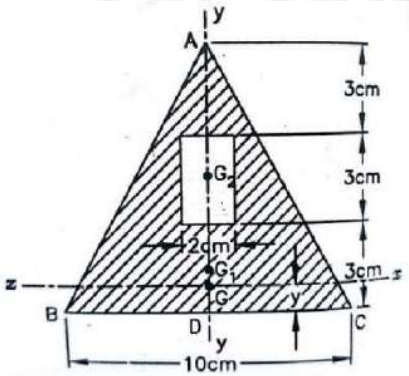
3. Determine the centroid of the given section



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of centroid for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed	Applying (Solve the problem based on the descriptions	6

	areas and masses	given in CO3 and CO4)	
Total			14

4. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC.



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of moment of inertia for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

Model Question Paper

QP CODE:

Reg No.:_____

Name:_____ ___

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 100

ENGINEERING MECHANICS

Max. Marks: 100 Duration: 3 hours

Part A

(Answer all questions; each question carries 3 marks)

1. Explain D'Alembert's principle

2. Distinguish static and dynamic frictioni.

3. State and explain perpendicular axis theorem.

4. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.

5. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar

6. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

7. Compare damped and undamped free vibrations.

8. State the equation of motion of a rotating rigid body, rotating about its fixed axis.

9. Illustrate the significance of instantaneous centre in the analysis of rigid body undergoing rotational motion.

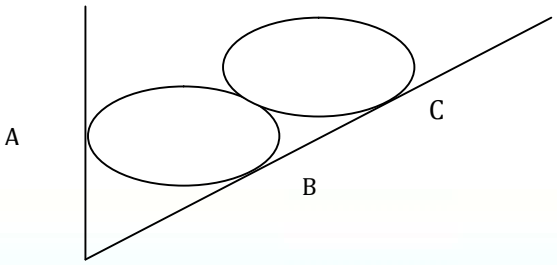
10. Highlight the principles of mechanics applied in the evaluation of elastic collusion of rigid bodies.

PART B

(Answer **one full** question from each module, each question carries **14** marks)

Module -I

11. Two identical rollers each of weight 100 N are supported by an inclined plane, making an angle of 30^{o} with the vertical, and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth. (14 marks)

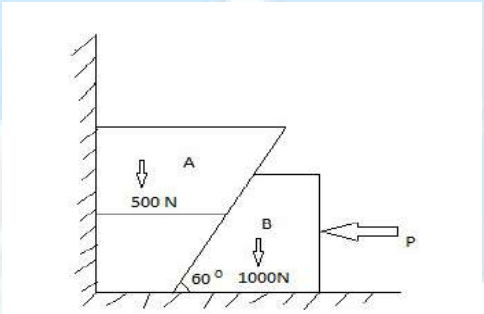


12. A string tied to a wall is made to pass over a pulley placed 2m away from it. A weight P is attached to the string such that the string stretches by 2m from the support on the wall to the location of attachment of weight. Determine the force P required to maintain 200 kg body in position for $\theta = 30^{o}$, The diameter of pulley B is negligible. (14 marks)

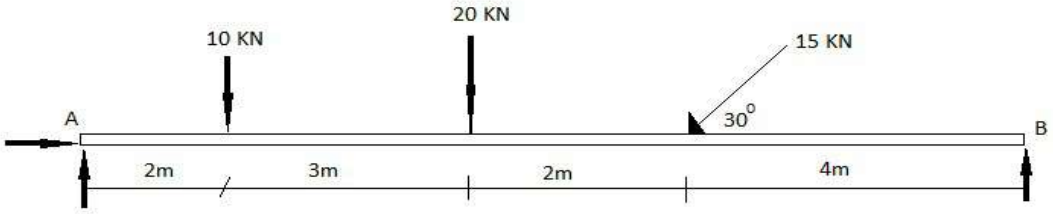
Module – 2

13. Two blocks A & B are resting against a wall and the floor as shown in figure below. Find the value of horizontal force P applied to the lower block that will hold the system in equilibrium. Coefficient of friction are : 0.25 at the floor, 0.3 at the wall and 0.2 between the blocks.

(14 marks)

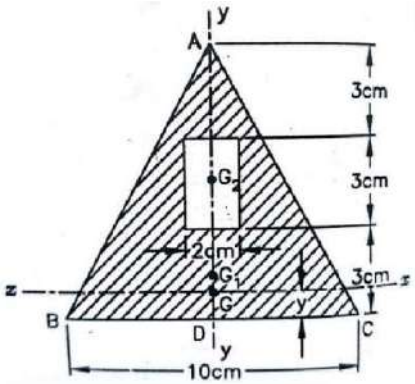


14. A beam is hinged at A and roller supported at B. It is acted upon by loads as shown below. Find the reactions at A & B. (14 marks)

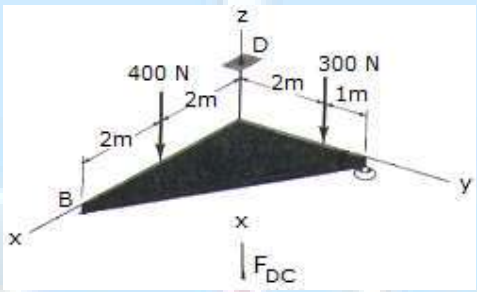


Module – 3

15. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC. (14 marks)



16. Support A has ball and socket connection. Roller support at B prevents motion in the —z direction. Corner *C* is tied to *D* by a rope. The triangle is weightless. Determine the unknown force components acting at *A*, *B*, and *C*. (14 marks)



Module - 4

17. A cricket ball is thrown by a fielder from a height of 2m at an angle of 30^0 to the horizontal with an initial velocity of 20 m/s , hits the wickets at a height of 0.5 m from the ground. How far was the fielder from the wicket? (14 marks)

18. An engine of weight 500 kN pull a train weighing 1500 kN up an incline of 1 in 100. The train starts from rest and moves with constant acceleration against a resistance of 5 N/kN. It attains a maximum speed of 36 kmph in 1 km distance. Determine the tension in the coupling between train and engine and the traction force developed by the engine. (14marks)

Module – 5

19. A cylindrical disc, 50 cm diameter and 10 cm thickness having mass of 10 kg, is in contact with a horizontal conveyor belt running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s in 10 seconds. Also compute the moment acting about the axis of the disc in both cases. (14 marks)

20. A wheel rotating about fixed axis at 20 rpm is uniformly accelerated for 70 seconds during which time it makes 50 revolutions. Find the (i) angular velocity at the end of this interval and (ii) time required for the velocity to reach 100 revolutions per minute. (14 marks)

SYLLABUS

Module 1

Introduction to Engineering Mechanics-statics-basic principles of statics-Parallelogram law, equilibrium law, principles of superposition and transmissibility, law of action and reaction(review) free body diagrams.

Concurrent coplanar forces-composition and resolution of forces-resultant and equilibrium equations – methods of projections – methods of moments – Varignon's Theorem of moments.

Module 2

Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –wedges, ladder-analysis of connected bodies .

Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads. General coplanar force system - resultant and equilibrium equations.

Module 3

Centroid of composite areas- – moment of inertia-parallel axis and perpendicular axis theorems. Polar moment of inertia,radius of gyration,mass moment of inertia-ring,cylinder and disc.

Theorem of Pappus Guldinus(demonstration only)

Forces in space - vectorial representation of forces, moments and couples –resultant and equilibrium equations – concurrent forces in space (simple problems only)

Module 4

Dynamics – rectilinear translation - equations of kinematics(review)

kinetics – equation of motion – D'Alembert's principle. – motion on horizontal and inclined surfaces, motion of connected bodies. Impulse momentum equation and work energy equation (concepts only).

Curvilinear translation - equations of kinematics –projectile motion(review), kinetics – equation of motion. Moment of momentum and work energy equation (concepts only).

Module 5

Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – rotation under a constant moment.

Plane motion of rigid body – instantaneous centre of rotation (concept only).

Simple harmonic motion – free vibration –degree of freedom- undamped free vibration of spring mass system-effect of damping(concept only)

Text Books

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers
2. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
3. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education.

References

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.

2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications

3. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers

4. F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill

5. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd.

Course Contents and Lecture Schedule:

Module	Topic	Course outcomes addressed	No. of Hours
1	**Module 1**		**Total: 7**
1.1	Introduction to engineering mechanics – introduction on statics and dynamics - Basic principles of statics – Parellogram law, equilibrium law – Superposition and transmissibility, law of action and reaction (review the topics)	CO1 and CO2	1
1.2	Free body diagrams. Degree of freedom-types of supports and nature of reactions - exercises for free body diagram preparation – composition and resolution of forces, resultant and equilibrium equations (review the topics) - numerical exercises for illustration.	CO1 and CO2	1
1.3	Concurrent coplanar forces - analysis of concurrent forces -methods of projections – illustrative numerical exercise – teacher assisted problem solving.	CO1 and CO2	1
1.4	Analysis of concurrent forces -methods of moment-Varignon's Theorem of Moments - illustrative numerical exercise– teacher assisted problem solving.	CO1 and CO2	1
1.5	Analysis of concurrent force systems – extended problem solving - Session I.	CO3,CO4 and CO5	1
1.6	Analysis of concurrent force systems – extended problem solving - Session II – learning review quiz.	CO3,CO4 and CO5	1
1.7	Analysis of concurrent force systems – extended problem solving - Session III.	CO3,CO4 and CO5	1
2	**Module 2**		**Total: 7**
2.1	Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –illustrative examples on wedges and ladder-teacher	CO1 and CO2	1

	assisted problem solving tutorials using problems from wedges and ladder.		
2.2	Problems on friction - analysis of connected bodies. illustrative numerical exercise– teacher assisted problem solving.	CO3, CO4 and CO5	1
2.3	Problems on friction-extended problem solving	CO3,C04 and CO5	1
2.4	Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads.	CO1 and CO2	1
2.5	General coplanar force system - resultant and equilibrium equations - illustrative examples- teacher assisted problem solving.	CO1 and CO2	1
2.6	General coplanar force system-resultant and equilibrium equations - illustrative examples	CO3, CO4 and CO5	1
2.7	General coplanar force system - Extended problem solving - Quiz to evaluate learning level.	CO3, CO4 and CO5	1
3	**Module 3**		**Total: 7**
3.1	Centroid of simple and regular geometrical shapes – centroid of figures in combination - composite areas- examples for illustration – problems for practice to be done by self.	CO1 and CO2	1
3.2	Moment of inertia- parallel axis theorem –examples for illustration - problems for practice to be done by self.	CO1 and CO2	1
3.3	Moment of inertia - perpendicular axis theorem - example for illustration to be given as hand out and discussion on the solved example.	CO1 and CO2	1
3.4	Solutions to practice problems – problems related to centroid and moment of inertia - problems for practice to be done by self.	CO3, CO4 and CO5	1
3.5	Polar moment of inertia, Radius of gyration. Mass moment of inertia of ring, cylinder and uniform disc. Theorem of Pappus Guldinus - Demonstration	CO1 and CO2	1
3.6	Introduction to forces in space – vectorial representation of forces, moments and couples – simple problems to illustrate vector representations of forces, moments and couples to be done in class.	CO1,and CO2	1
3.7	Solution to practice problems - resultant and equilibrium equations for concurrent forces in space – concurrent forces in space - 2 simple problems to illustrate the application of resultant and equilibrium equations for concurrent forces in space.	CO3,CO4 and CO5	1
4	**Module 4**		**Total: 7**

4.1	Introduction to dynamics – review of rectilinear translation - equations of kinematics – problems to review the concepts – additional problems involving extended application as exercises .	CO1 and CO2	1
4.2	Solutions to exercises with necessary explanation given as hand out – introduction to kinetics – equation of motion – D'Alembert's principle – illustration of the concepts using one numerical exercise from motion on horizontal and inclined surfaces.	CO1 and CO2	1
4.3	Motion of connected bodies - example for illustration to be given as hand out and discussion on the solved example – problems for practice to be done by self.	CO3, CO4 and CO5	1
4.4	Motion of connected bodies-extended problem solving.	CO3, CO4 & CO5	1
4.5	Curvilinear translation - Review of kinematics –projectile motion – simple problems to review the concepts – introduction to kinetics – equation of motion – illustration of the concepts using numerical exercises.	CO3, CO4 & CO5	1
4.6	Extended problem solving – rectilinear and curvilinear translation.	CO3, CO4 & CO5	1
4.7	Concepts on Impulse momentum equation and work energy equation (rectilinear translation – discussions to bring out difference between elastic and inelastic collusions). Concepts on Moment of momentum and work energy equation (curvilinear translation).	CO1 and CO2	1
5	**Module 5**		**Total: 7**
5.1	Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – simple problems for illustration.	CO1 and CO2	1
5.2	Rotation under a constant moment – teacher assisted problem solving.	CO3,CO4 and CO5	1
5.3	Rotation under a constant moment - extended problem solving.	CO3, CO4 and CO5	1
5.4	Plane motion of rigid body- instantaneous centre of rotation (concept only).	CO1 and CO2	1
5.5	Introduction to harmonic oscillation –free vibrations - simple harmonic motion – differential equation and solution. Degree of freedom – examples of single degree of freedom (SDOF) systems – Idealisation of mechanical systems as spring-mass systems (concept only).	CO1 and CO2	1

5.6	SDOF spring mass system –equation of motion – undamped free vibration response - concept of natural frequency. Free vibration response due to initial conditions. Simple problems on determination of natural frequency and free vibration response to test the understanding level.	CO1 and CO2	1
5.7	Free vibration analysis of SDOF spring-mass systems – Problem solving Effect of damping on free vibration response (concept only).	CO1and CO2	1

EST 110	ENGINEERING GRAPHICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	0	2	3	2019

Preamble: To enable the student to effectively perform technical communication through graphical representation as per global standards.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Draw the projection of points and lines located in different quadrants
CO 2	Prepare multiview orthographic projections of objects by visualizing them in different positions
CO 3	Draw sectional views and develop surfaces of a given object
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three dimensions.
CO 5	Convert 3D views to orthographic views
CO 6	Obtain multiview projections and solid models of objects using CAD tools

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3											
CO 3	3	1										
CO 4	3									1		
CO 5	3									2		
CO 6	3				3					3		

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (100 Marks)
	Test 1 (15 Marks)	Test 2 (15 Marks)	
Remember			
Understand	5		20
Apply	10	10	80
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

CIA for section A carries 25 marks (15 marks for 1 test and Class work 10 marks)

CIA for section B carries 15 marks (10 marks for 1 test and Class work 5 marks)

End Semester Examination Pattern:

ESE will be of 3 hour duration on A4 size answer booklet and will be for 100 marks. The question paper shall contain two questions from each module of Section A only. Student has to answer any one question from each module. Each question carries 20 marks.

Course Level Assessment Questions

(Questions may be framed based on the outline given under each course outcome)

Course Outcome 1 (CO1):

1. Locate points in different quadrants as per given conditions.
2. Problems on lines inclined to both planes .
3. Find True length, Inclinations and Traces of lines.

Course Outcome 2 (CO2)

1. Draw orthographic views of solids and combination solids
2. Draw views of solids inclined to any one reference plane.
3. Draw views of solids inclined to both reference planes.

Course Outcome 3 (CO3):

1. Draw views of solids sectioned by a cutting plane
2. Find location and inclination of cutting plane given true shape of the section
3. Draw development of lateral surface of solids and also its sectioned views

Course Outcome 4 (CO4):

1. Draw Isometric views/projections of soilds
2. Draw Isometric views/projections of combination of soilds
3. Draw Perspective views of Soilds

Course Outcome 5 (CO5):

1. Draw Orthographic views of solids from given three dimensional view

Course Outcome 6 (CO6):

1. Draw the given figure including dimensions using 2D software
2. Create 3D model using modelling software from the given orthographic views or 3D figure or from real 3D objects

Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 110

ENGINEERING GRAPHICS

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

Instructions: Retain necessary Construction lines
Show necessary dimensions
Answer any ONE question from each module
Each question carries 20 marks

MODULE I

1. The end point A of a line is 20mm above HP and 10mm in front of VP. The other end of the line is 50mm above HP and 15mm behind VP. The distance between the end projectors is 70mm. Draw the projections of the line. Find the true length and true inclinations of the line with the principal planes. Also locate the traces of the line.
2. One end of a line is 20mm from both the principal planes of projection. The other end of the line is 50mm above HP and 40mm in front of VP. The true length of the line is 70mm. Draw the projections of the line. Find its apparent inclinations, elevation length and plan length. Also locate its traces.

MODULE II

3. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined 30^{o} to VP. Draw the projections of the solid.

4. A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at 30° to HP and 45° to VP. Draw the projections of the solid.

MODULE III

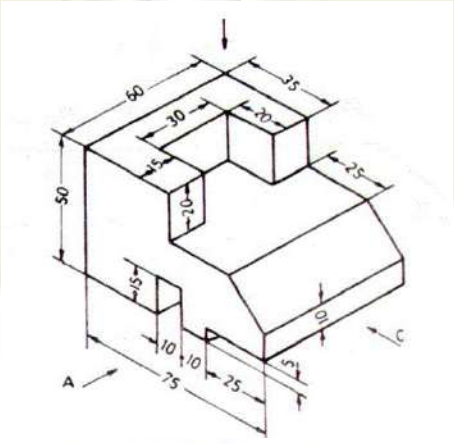
5. A triangular prism of base side 40mm and height 70mm is resting with its base on the ground and having an edge of the base perpendicular to VP. Section the solid such that the true shape of the section is a trapezium of parallel sides 30mm and 10mm. Draw the projections showing the true shape. Find the inclination of the cutting plane with the ground plane.
6. Draw the development of a pentagonal pyramid of base side 30mm and height 50mm. A string is wound from a corner of the base round the pyramid and back to the same point through the shortest distance. Show the position of the string in the elevation and plan.

MODULE IV

7. The frustum of a cone has base diameter 50mm and top diameter 40mm has a height of 60mm. It is paced centrally on top of a rectangular slab of size 80x60mm and of thickness 20mm. Draw the isometric view of the combination.
8. A hexagonal prism has base side 35mm and height 60mm. A sphere of diameter 40mm is placed centrally on top of it. Draw the isometric projection of the combination.

MODULE V

9. Draw the perspective view of a pentagonal prism, 20mm side and 45mm long lying on one of its rectangular faces on the ground and having its axis perpendicular to picture plane. One of its pentagonal faces touches the picture plane and the station point is 50mm in front of PP, 25mm above the ground plane and lies in a central plane, which is 70mm to the left of the center of the prism.
10. Draw three orthographic views with dimensions of the object shown in figure below.



(20X5=100)

Time : 3 hours **EST110 ENGINEERING GRAPHICS** **Max. Marks: 100**

SCHEME OF VALUATION

1. Locating the points and drawing the projections of the line – 4 marks
   Finding true length by any one method – 6 marks
   Finding true inclination with VP – 2 marks
   Finding true inclination with HP – 2 marks
   Locating horizontal trace – 2 marks
   Locating vertical trace – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

2. Locating the points and drawing true length of the line – 4 marks
   Finding projections by any method – 6 marks
   Finding length of elevation and plan – 2 marks
   Finding apparent inclinations – 2 marks
   Locating horizontal trace – 2 marks
   Locating vertical trace – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

3. Drawing initial position plan and elevation – 4 marks
   First inclination views – 4 marks
   Second inclination views -8 marks
   Marking invisible edges – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Any one method or combination of methods for solving can be used.
   If initial position is wrong then maximum 50% marks may be allotted for the answer)

4. Drawing initial position plan and elevation – 4 marks
   First inclination views – 4 marks
   Second inclination views -8 marks
   Marking invisible edges – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Any one method or combination of methods for solving can be used
   If initial position is wrong then maximum 50% marks may be allotted for the answer)

5. Drawing initial position plan and elevation – 4 marks
   Locating section plane as per given condition – 5 marks
   Drawing true shape -5 marks
   Finding inclination of cutting plane – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

6. Drawing initial position plan and elevation – 4 marks
   Development of the pyramid – 6 marks

Locating string in development -2 marks
Locating string in elevation – 3 marks
Locating string in plan – 3 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

7. Drawing initial positions – 4 marks
   Isometric View of Slab -6 marks
   Isometric View of Frustum – 10 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Initial position is optional, hence redistribute if needed.
   Reduce 4 marks if Isometric scale is taken)

8. Drawing initial positions – 4 marks
   Isometric scale – 4 marks
   Isometric projection of prism -5 marks
   Isometric projection of sphere – 5 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Initial position is optional, hence redistribute if needed.

9. Drawing the planes and locating the station point – 4 marks
   Locating elevation points – 2 marks
   Locating plan points – 2 marks
   Drawing the perspective view – 10 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

10. Drawing the elevation – 8marks
    Drawing the plan – 4 marks
    Drawing the side view – 4 marks
    Marking invisible edges – 2 marks
    Dimensioning and neatness – 2 marks

    Total = 20 marks

SYLLABUS

General Instructions:

- First angle projection to be followed
- Section A practice problems to be performed on A4 size sheets
- Section B classes to be conducted on CAD lab

SECTION A

Module 1

Introduction : Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.

Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes.

Module 2

Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.

Module 3

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given.

Development of Surfaces: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.

Module 4

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone , Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.

Module 5

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane.

Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.

SECTION B

(To be conducted in CAD Lab)

Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two dimensional drawing with dimensions using suitable software. (Minimum 2 exercises mandatory)

Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory)

Text Books

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.

Reference Books

1. Anilkumar, K.N., Engineering Graphics, Adhyuth narayan Publishers
2. Agrawal, B. And Agrawal, C.M., Engineering Darwing, Tata McGraw Hill Publishers.
3. Benjamin, J., Engineering Graphics, Pentex Publishers- 3rd Edition, 2017
4. Duff, J.M. and Ross, W.A., Engineering Design and Visualisation, Cengage Learning.
5. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K., Engineering Graphics with AutoCAD, PHI.
6. Luzaddff, W.J. and Duff, J.M., Fundamentals of Engineering Drawing, PHI.
7. Varghese, P.I., Engineering Graphics, V I P Publishers
8. Venugopal, K., Engineering Drawing and Graphics, New Age International Publishers.

Course Contents and Lecture Schedule

No	**SECTION A**	No. of Hours
1	**MODULE I**	
1.1	Introduction to graphics, types of lines, Dimensioning	1
1.2	Concept of principle planes of projection, different quadrants, locating points on different quadrants	2
1.3	Projection of lines, inclined to one plane. Lines inclined to both planes, trapezoid method of solving problems on lines.	2
1.4	Problems on lines using trapezoid method	2
1.5	Line rotation method of solving, problems on line rotation method	2
2	**MODULE II**	
2.1	Introduction of different solids, Simple position plan and elevation of solids	2
2.2	Problems on views of solids inclined to one plane	2
2.3	Problems on views of solids inclined to both planes	2
2.4	Practice problems on solids inclined to both planes	2

3	**MODULE III**	
3.1	Introduction to section planes. AIP and AVP. Principle of locating cutting points and finding true shape	2
3.2	Problems on sections of different solids	2
3.3	Problems when the true shape is given	2
3.4	Principle of development of solids, sectioned solids	2
4	**MODULE IV**	
4.1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2
4.2	Isometric problems on Frustum of solids, Sphere and Hemisphere	2
4.3	Problems on combination of different solids	2
5	**MODULE V**	
5.1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2
5.2	Perspective problems on prisms	2
5.3	Practice on conversion of pictorial views into orthographic views	2
	SECTION B *(To be conducted in CAD lab)*	
1	Introduction to CAD and software. Familiarising features of 2D software. Practice on making 2D drawings	2
2	Practice session on 2D drafting	2
3	Introduction to solid modelling and software	2
4	Practice session on 3D modelling	2

EST 120	BASICS OF CIVIL & MECHANICAL ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

To introduce the students to the basic principles of mechanical engineering

Prerequisite: NIL

Course Outcomes: After completion of the course, the student will be able to

CO 1	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
CO 2	Explain different types of buildings, building components, building materials and building construction
CO 3	Describe the importance, objectives and principles of surveying.
CO 4	Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps
CO 5	Discuss the Materials, energy systems, water management and environment for green buildings.
CO 6	Analyse thermodynamic cycles and calculate its efficiency
CO 7	Illustrate the working and features of IC Engines
CO 8	Explain the basic principles of Refrigeration and Air Conditioning
CO 9	Describe the working of hydraulic machines
CO 10	Explain the working of power transmission elements
CO 11	Describe the basic manufacturing, metal joining and machining processes

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	3	2	2	-	-	-	-
CO2	3	2	-	1	3	-	-	3	-	-	-	-
CO3	3	2	-	-	3	-	-	-	2	-	-	-

CO4	3	2	-	-	3	-	-	-	2	-	-	-
CO5	3	2	-	-	3	2	3	-	2	-	-	-
CO6	3	2										
CO7	3	1										
CO8	3	1										
CO9	3	2										
CO10	3	1										
CO11	3											

Assessment Pattern

Bloom's Category	**Basic Civil Engineering**			**Basic Mechanical Engineering**		
	Continuous Assessment		**End Semester Examination (marks)**	**Continuous Assessment**		**End Semester Examination (marks)**
	Test 1 marks	**Test 2 marks**		**Test 1 marks**	**Test 2 marks**	
Remember	5	5	10	7.5	7.5	15
Understand	20	20	40	12.5	12.5	25
Apply				5	5	10
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	**CIE (Marks)**	**ESE (Marks)**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern:

There will be two parts; Part I – Basic Civil Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts -

Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions:

Course Outcome CO1: *To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.*

1.Explain relevance of Civil engineering in the overall infrastructural development of the country.
Course outcome 2 (CO2) (One question from each module and not more than two)

Explain different types of buildings, building components, building materials and building construction

1. Discuss the difference between plinth area and carpet area.

Course outcome 3 (CO3) (One question from each module and not more than two)

Describe the importance, objectives and principles of surveying.

1. Explain the importance of surveying in Civil Engineering

Course outcome 4 (CO4) (One question from each module and not more than two)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps

1. Explain the civil engineering aspects of elevators, escalators and ramps in buildings

Course outcome 5 (CO5) (One question from each module and not more than two)

Discuss the Materials, energy systems, water management and environment for green buildings.

1. Discuss the relevance of Green building in society

Section II *Answer any 1 full question from each module. Each full question carries 10 marks*

Course Outcome 1 (CO1) (Two full question from each module and each question can have maximum 2 sub-divisions)

To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering
CO Questions

1. a List out the types of building as per occupancy. Explain any two, each in about five sentences.
b. Discuss the components of a building with a neat figure.
2. a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework.

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country.

Course Outcome 2 (CO2) & Course Outcome 3 (CO3) (Two full question from each module and each question can have maximum 2 sub-divisions)

Explain different types of buildings, building components, building materials and building construction & Describe the importance, objectives and principles of surveying.

CO Questions

1. **a.** What are the different kinds of cement available and what is their use.
   b. List the properties of good building bricks. Explain any five.
2. a. List and explain any five modern construction materials used for construction.
   b. Explain the objectives and principles of surveying

Course outcome 4 (CO4) & Course outcome 5 (CO5) (Two full question from each module and each question can have maximum 2 sub-divisions)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps & Discuss the Materials, energy systems, water management and environment for green buildings.

CO Questions

1. **a**. Draw the elevation and plan of one brick thick wall with English bond
   b. Explain the energy systems and water management in Green buildings

2. **a.** Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing.

   b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building

Course Outcome 6 (CO6):

1. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35^{o}C, 0.1 MPa. The maximum temperature of the cycle is 1100^{o}C. Find
   i) Heat supplied per kg of air,
   ii) Work done per kg of air,
   iii) Cycle efficiency
   Take Cp = 1.005 kJ/kgK and Cv=0.718 kJ/kgK
2. A Carnot cycle works with adiabatic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of isothermal expansion is 0.3 m^{3}. If the maximum temperature and pressure is limited to 550K and 21 bar, determine the minimum temperature in the cycle and efficiency of the cycle.
3. In an ideal diesel cycle, the temperature at the beginning and end of compression is 65^{o}C and 620^{o}C respectively. The temperature at the beginning and end of the expansion is 1850^{o}C and 850 ^{o}C. Determine the ideal efficiency of the cycle.

4. Explain the concepts of CRDI and MPFI in IC Engines.

Course Outcome 7 (CO7)

1. With the help of a neat sketch explain the working of a 4 stroke SI engine
2. Compare the working of 2 stroke and 4 stroke IC engines
3. Explain the classification of IC Engines.

Course Outcome 8(CO8):

1. Explain the working of vapour compression refrigeration system.
2. With the help of suitable sketch explain the working of a split air conditioner.
3. Define: COP, specific humidity, relative humidity and dew point temperature.

Course Outcome 9 (CO9):

1. Explain the working of a single stage centrifugal pump with sketches.
2. With the help of a neat sketch, explain the working of a reciprocating pump.
3. A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s. If the overall efficiency of the turbine is 90%. Determine the power developed by the turbine.

Course Outcome 10 (CO10):

1. Explain the working of belt drive and gear drive with the help of neat sketches
2. Explain a single plate clutch.
3. Sketch different types of gear trains and explain.

Course Outcome 11 (CO11):

1. Describe the operations which can be performed using drilling machine.
2. Explain the functions of runners and risers used in casting.
3. With a neat sketch, explain the working and parts of a lathe.

Model Question Paper

QP CODE: **EST120** page:3

Reg No:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 120

Course Name: BASICS OF CIVIL AND MECHANICAL ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

PART I: BASIC CIVIL ENGINEERING

PART A

(Answer all questions. Each question carries 4 marks)

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.
2. Discuss the difference between plinth area and carpet area.
3. Explain different types of steel with their properties.
4. What are the different kinds of cement available and what is their use?
5. Define bearing capacity of soil.

(5 x 4 = 20)

Part B

Answer one full question from each module.

MODULE I

6a. List out the types of building as per occupancy. Explain any two, each in about five sentences. (5)

b. Discuss the components of a building with a neat figure. (5)

OR

7a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework. (5)

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country. (5)

MODULE II

8a. What are the different kinds of cement available and what is their use. (5)

b. List the properties of good building bricks. Explain any five. (5)

OR

9a. List and explain any five modern construction materials used for construction. (5)

b. Explain the objectives and principles of surveying (5)

MODULE III

10a. Draw the elevation and plan of one brick thick wall with English bond (5)

b. Explain the energy systems and water management in Green buildings (5)

OR

11a. Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing. (5)

b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building (5)

[10 x 3 = 30]

PART II: BASIC MECHANICAL ENGINEERING

PART A

Answer all questions. Each question carries 4 marks

1. Sketch the P-v and T-s diagram of a Carnot cycle and List the processes.
2. Illustrate the working of an epicyclic gear train.
3. Explain cooling and dehumidification processes.
4. Differentiate between soldering and brazing.
5. Explain the principle of Additive manufacturing.

4 x 5 = 20 marks

Part B

Answer one full question from each module.

MODULE I

6. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35^{o}C, 0.1MPa. The maximum temperature of the cycle is 1100^{o}C. Find
   i) Heat supplied per kg of air,
   ii) Work done per kg of air,
   iii)Cycle efficiency

   Take C_p = 1.005 kJ/kgK and C_v=0.718 kJ/kgK — 10 marks

OR

7. a) Explain the working of a 4 stroke SI engine with neat sketches. — 7 marks
   b) Explain the fuel system of a petrol engine. — 3 marks

MODULE II

8. a) Explain the working of a vapour compression system with help of a block diagram. — 7 marks
   b) Define: Specific humidity, relative humidity and dew point temperature. — 3 marks

OR

9. With the help of a neat sketch, explain the working of a centrifugal pump. — 10 marks

MODULE III

10. Explain the two high, three high, four high and cluster rolling mills with neat sketches. — 10 marks

OR

11. a) Describe the arc welding process with a neat sketch. — 6 marks
    b) Differentiate between up-milling and down-milling operations. — 4 marks

SYLLABUS

Module 1

General Introduction to Civil Engineering: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.

Introduction to buildings: Types of buildings, selection of site for buildings, components of a residential building and their functions.

Building rules and regulations: Relevance of NBC, KBR & CRZ norms (brief discussion only).

Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

Module 2

Surveying: Importance, objectives and principles.

Construction materials, Conventional construction materials**:** types, properties and uses of building materials: bricks, stones, cement, sand and timber

Cement concrete: Constituent materials, properties and types.

Steel: Steel sections and steel reinforcements, types and uses.

Modern construction materials:- Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).

Module 3

Building Construction: Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Load bearing and framed structures (concept only).

Brick masonry: - Header and stretcher bond, English bond & Flemish bond random rubble masonry.

Roofs and floors: - Functions, types; flooring materials (brief discussion only).

Basic infrastructure services: MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings.

Green buildings:- Materials, energy systems, water management and environment for green buildings. (brief discussion only).

Module 4

Analysis of thermodynamic cycles: Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency. IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines(Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.

Module 5

Refrigeration: Unit of refrigeration, reversed Carnot cycle,COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.

Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)

Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

Module 6

Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.

Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications

Basic Machining operations: Turning, Drilling, Milling and Grinding.

Description about working with block diagram of: Lathe, Drilling machine, Milling machine, CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.

Text Books:

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. Mckay, W.B. and Mckay, J. K., Building Construction, Volumes 1 to 4, Pearson India Education Services

References Books:

1. Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
2. Chudley, R and Greeno R, Building construction handbook, Addison Wesley, Longman group, England
3. Chudley, R, Construction Technology, Vol. I to IV, Longman group, England Course Plan
4. Kandya A A, Elements of Civil Engineering, Charotar Publishing house
5. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
6. Rangwala S.C and Dalal K B Building Construction Charotar Publishing house
7. Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
8. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters &Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018
11. Benjamin,J.,Basic Mechanical Engineering,Pentex Books,9th Edition,2018
12. Balachandran, P.Basic Mechanical Engineering,Owl Books

Course Contents and Lecture Schedule:

No	Topic	Course outcomes addressed	No. of Lectures
1	**Module I**		**Total: 7**
1.1	*General Introduction to Civil Engineering*: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment.	CO1	1
1.2	Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.	CO1	2
1.3	*Introduction to buildings:* Types of buildings, selection of site for buildings, components of a residential building and their functions.	CO2	2
1.4	*Building rules and regulations:* Relevance of NBC, KBR & CRZ norms (brief discussion only)	CO2	1
1.5	*Building area:* Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.	CO2	1
2	**Module 2**		**Total: 7**
2.1	*Surveying:* Importance, objectives and principles.	CO3	1
2.2	Bricks: - Classification, properties of good bricks, and tests on bricks	CO2	1
2.3	Stones: - *Qualities* of good stones, types of stones and their uses. Cement: - Good qualities of cement, types of cement and their uses.	CO2	1
2.4	Sand: - Classification, qualities of good sand and sieve analysis (basics only). Timber: - Characteristics, properties and uses.	CO2	1
2.5	Cement concrete: - Constituent materials, properties and types, Steel: - Steel sections and steel reinforcements, types and uses.	CO2	1

2.6	Modern construction materials: - Architectural glass, ceramics, plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials, modern uses of gypsum, pre-fabricated building components (brief discussion only)	CO2	2
3	**Module 3**		**Total: 7**
3.1	Foundations: - Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Brick masonry: - Header and stretcher bond, English bond & Flemish bond– elevation and plan (one & one and a half brick wall only). Random rubble masonry.	CO2	2
3.2	Roofs: Functions, types; roofing materials (brief discussion only) Floors: Functions, types; flooring materials (brief discussion only)	CO2	2
3.3	*Basic infrastructure services:* MEP, HVAC, Elevators, escalators and ramps (Civil Engineering aspects only) fire safety for buildings	CO4	2
3.4	*Green buildings:*- Materials, energy systems, water management and environment for green buildings. (brief discussion only)	CO5	1
4	**MODULE 4**		
4.1	Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle- Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency	4	
4.2	IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines, efficiencies of IC Engines(Description only)	2	
4.3	Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines	2	
5	**MODULE 5**		
5.1	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems)	1	
5.2	Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.	1	

5.3	Description about working with sketches : Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)	4
5.4	Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches	3
6	**MODULE 6**	
6.1	Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.	2
6.2	Metal Joining Processes :List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications	1
6.3	Basic Machining operations: Turning, Drilling, Milling and Grinding Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine	3
6.4	Principle of CAD/CAM, Rapid and Additive manufacturing	1

EST 130	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

This course aims to (1) equip the students with an understanding of the fundamental principles of electrical engineering(2) provide an overview of evolution of electronics, and introduce the working principle and examples of fundamental electronic devices and circuits (3) provide an overview of evolution of communication systems, and introduce the basic concepts in radio communication.

Prerequisite: Physics and Mathematics (Pre-university level)

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO 2	Develop and solve models of magnetic circuits
CO 3	Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state
CO 4	Describe working of a voltage amplifier
CO 5	Outline the principle of an electronic instrumentation system
CO 6	Explain the principle of radio and cellular communication

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	1	-	-	-	-	-	-	-	-	-	2
CO 3	3	1	-	-	-	-	-	-	-	-	-	2
CO 4	2	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	2
CO 6	2	-	-	-	-	-	-	-	-	-	-	2

Assessment Pattern

Bloom's Category	Basic Electrical Engineering			Basic Electronics Engineering		
	Continuous Assessment Tests		End Semester Examination (Marks)	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)		Test 1 (Marks)	Test 2 (Marks)	
Remember	0	0	10	10	10	20
Understand	12.5	12.5	20	15	15	30
Apply	12.5	12.5	20			
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part I – Basic Electrical Engineering and Part II – Basic Electronics Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts - Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Solve problems based on current division rule.

2. Solve problems with Mesh/node analysis.

3. Solve problems on Wye-Delta Transformation.

Course Outcome 2 (CO2):

1. Problems on series magnetic circuits

2. Problems on parallel magnetic circuits

3. Problems on composite magnetic ciruits

4. **Course Outcome 3 (CO3):**

1. problems on self inductance, mutual inductance and coefficient of coupling

2. problems on rms and average values of periodic waveforms

3. problems on series ac circuits

4. Compare star and Delta connected 3 phase AC systems.

Course Outcome 4 (CO4): Describe working of a voltage amplifier

1.What is the need of voltage divider biasing in an RC coupled amplifier?

2. Define operating point in the context of a BJT amplifier.

3. Why is it required to have a voltage amplifier in a public address system?

Course Outcome 5 (CO5): Outline the principle of an electronic instrumentation system

1. Draw the block diagram of an electronic instrumentation system.

2. What is a transducer?

3. Explain the working principle of operation of digital multimeter.

Course Outcome 6 (CO6): Explain the principle of radio and cellular communication

1. What is the working principle of an antenna when used in a radio transmitter?

2. What is the need of two separate sections RF section and IF section in a super heterodyne receiver?

3. What is meant by a cell in a cellular communication?

Model Question Paper

QP CODE: Pages: 3

Reg No.:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 130

Course Name: BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

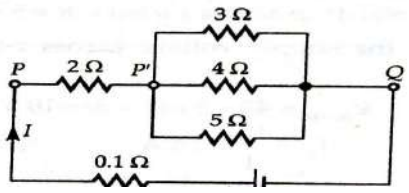
PART I

BASIC ELECTRICAL ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Calculate the current through the 4Ω resistor in the circuit shown, applying current division rule:



2. Calculate the RMS and average values of a purely sinusoidal current having peak value 15A.

3. An alternating voltage of (80+j60)V is applied to an RX circuit and the current flowing through the circuit is (-4+j10)A. Calculate the impedance of the circuit in rectangular and polar forms. Also determine if X is inductive or capacitive.

4. Derive the relation between line and phase values of voltage in a three phase star connected system.

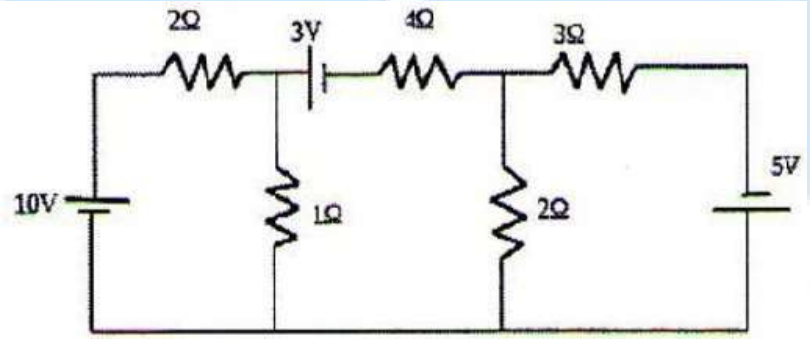
5. Compare electric and magnetic circuits. *(5x4=20)*

PART B

Answer one question from each module; each question carries 10 marks.

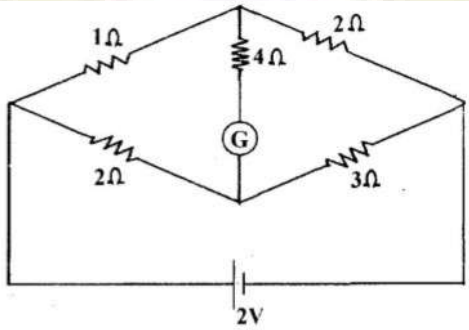
Module 1

6. . Calculate the node voltages in the circuit shown, applying node analysis:



7. (a) State and explain Kirchhoff's laws. (4 marks)

(b) Calculate the current through the galvanometer (G) in the circuit shown:



(6 marks)

Module 2

8. (a) State and explain Faraday's laws of electromagnetic induction with examples. (4 marks)

(b) Differentiate between statically and dynamically induced emf. A conductor of length 0.5m moves in a uniform magnetic field of flux density 1.1T at a velocity of 30m/s. Calculate the emf induced in the conductor if the direction of motion of the conductor is inclined at 60^0 to the direction of field. (6 marks)

9. (a) Derive the amplitude factor and form factor of a purely sinusoidal waveform. (5 marks)

(b) A current wave is made up of two components-a 5A dc component and a 50Hz ac component, which is a sinusoidal wave with a peak value of 5A. Sketch the resultant waveform and determine its RMS and average values. (5 marks)

Module 3

10. Draw the power triangle and define active, reactive and apparent powers in ac circuits. Two coils A and B are connected in series across a 240V, 50Hz supply. The resistance of A is 5Ω and the inductance of B is 0.015H. If the input from the supply is 3kW and 2kVAR, find the inductance of A and the resistance of B. Also calculate the voltage across each coil.

11. A balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the loads are connected in (i) star (ii) delta.

(3x10=30)

PART II

BASIC ELECTRONICS ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Give the specifications of a resistor. The colour bands marked on a resistor are Blue, Grey, Yellow and Gold. What are the minimum and maximum resistance values expected from that resistance?
2. What is meant by avalanche breakdown?
3. Explain the working of a full-wave bridge rectifier.
4. Discuss the role of coupling and bypass capacitors in a single stage RC coupled amplifier.
5. Differentiate AM and FM communication systems.

(5x4=20)

PART B

Answer one question from each module; each question carries 10 marks.

Module 4

6. a) Explain with diagram the principle of operation of an NPN transistor. (5)
   b) Sketch and explain the typical input-output characteristics of a BJT when connected in common emitter configuration. (5)

OR

7. a) Explain the formation of a potential barrier in a P-N junction diode. (5)
   b) What do you understand by Avalanche breakdown? Draw and explain the V-I characteristics of a P-N junction and Zener diode. (5)

Module 5

8. a) With a neat circuit diagram, explain the working of an RC coupled amplifier. (6)
   b) Draw the frequency response characteristics of an RC coupled amplifier and state the reasons for the reduction of gain at lower and higher frequencies. (4)

OR

9. a) With the help of block diagram, explain how an electronic instrumentation system. (6)
   b) Explain the principle of an antenna. (4)

Module 6

10. a) With the help of a block diagram, explain the working of Super hetrodyne receiver. (6)
    b) Explain the importance of antenna in a communication system. (4)

OR

11. a) With neat sketches explain a cellular communication system. (5)
    b) Explain GSM communication with the help of a block diagram. (5)

(3x10=30)

SYLLABUS

MODULE 1: Elementary Concepts of Electric Circuits

Elementary concepts of DC electric circuits: Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.

Analysis of DC electric circuits: Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.

MODULE 2: Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals

Magnetic Circuits: Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.

Electromagnetic Induction: Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling

Alternating Current fundamentals: Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.

MODULE 3: AC Circuits

AC Circuits: Phasor representation of sinusoidal quantities. Trignometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.

Three phase AC systems: Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems

MODULE 4

Introduction to Semiconductor devices: Evolution of electronics – Vacuum tubes to nano electronics. Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, color coding. PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration.

MODULE 5

Basic electronic circuits and instrumentation: Rectifiers and power supplies: Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

MODULE 6

Introduction to Communication Systems: Evolution of communication systems – Telegraphy to 5G. Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge. Mobile communication: basic principles of cellular communications, principle and block diagram of GSM.

Text Books

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. ChinmoySaha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.
4. M.S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
5. Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010.

Reference Books

1. Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
3. Hayt W H, Kemmerly J E, and Durbin S M, "Engineering Circuit Analysis", Tata McGraw-Hill
4. Hughes, "Electrical and Electronic Technology", Pearson Education.
5. V. N. Mittle and Arvind Mittal, "Basic Electrical Engineering," Second Edition, McGraw Hill.
6. Parker and Smith, "Problems in Electrical Engineering", CBS Publishers and Distributors.
7. S. B. Lal Seksena and Kaustuv Dasgupta, "Fundamentals of Electrical Engineering", Cambridge University Press.
8. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
9. Bernard Grob, Ba sic Electronics, McGraw Hill.
10. A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lectures
1	***Elementary Concepts of Electric Circuits***	
1.1	**Elementary concepts of DC electric circuits:** Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.	1 2 1
1.2	**Analysis of DC electric circuits:** Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.	1 1 2
2	**Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals**	
2.1	**Magnetic Circuits:** Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.	1 2
2.2	**Electromagnetic Induction:** Faraday's laws, problems, Lenz's law-statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling	1 2
2.3	**Alternating Current fundamentals:** Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.	2
3	**AC Circuits**	

3.1	**AC Circuits:** Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power, Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.	1 2 1 2
3.2	**Three phase AC systems:** Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems.	2
4	**Introduction to Semiconductor devices**	
4.1	Evolution of electronics – Vacuum tubes to nano electronics (In evolutional perspective only)	1
4.2	Resistors, Capacitors and Inductors: types, specifications. Standard values, color coding (No constructional features)	2
4.3	**PN Junction diode**: Principle of operation, V-I characteristics, principle of avalanche breakdown	2
4.4	**Bipolar Junction Transistors:** PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration	3
5	**Basic electronic circuits and instrumentation**	
5.1	**Rectifiers and power supplies:** Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator	3
5.2	**Amplifiers:** Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing	4
5.3	**Electronic Instrumentation:** Block diagram of an electronic instrumentation system	2
6	**Introduction to Communication Systems**	
6.1	Evolution of communication systems – Telegraphy to 5G	1

6.2	**Radio communication:** principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge	4
6.3	**Mobile communication:** basic principles of cellular communications, principle and block diagram of GSM.	2

Suggested Simulation Assignments for Basic Electronics Engineering

1. Plot V-I characteristics of Si and Ge diodes on a simulator
2. Plot Input and Output characteristics of BJT on a simulator
3. Implementation of half wave and full wave rectifiers
4. Simulation of RC coupled amplifier with the design supplied
5. Generation of AM signal

Note: The simulations can be done on open tools such as QUCS, KiCad, GNURadio or similar software to augment the understanding.

HUN 101	LIFE SKILLS	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		MNC	2	0	2	---	2019

Preamble: Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underly personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to

CO 1	Define and Identify different life skills required in personal and professional life
CO 2	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.
CO 3	Explain the basic mechanics of effective communication and demonstrate these through presentations.
CO 4	Take part in group discussions
CO 5	Use appropriate thinking and problem solving techniques to solve new problems
CO 6	Understand the basics of teamwork and leadership

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2		1	2	2	1	3
CO 2									3			2
CO 3						1			1	3		
CO 4										3		1
CO 5		3	2	1								
CO 6						1			3			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

Continuous Internal Evaluation
Total Marks: 50

Attendance	: 10 marks
Regular assessment	: 15 marks
Series test (one test only, should include first three modules)	: 25 marks

Regular assessment

- Group Discussion (Marks: 9)

  Create groups of about 6 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation are as follows:

  - Communication Skills : 3 marks
  - Subject Clarity : 2 marks
  - Group Dynamics : 2 marks
  - Behaviours & Mannerisms : 2 marks

- Presentation Skills (Marks: 6)

  Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation are as follows:

  - Communication Skills : 2 marks
  - Platform Skills : 2 marks
  - Subject Clarity/Knowledge : 2 marks

End Semester Examination
Total Marks: 50 **Time: 2 hrs.**

Part A: Short answer question (25 marks)
There will be one question from each MODULE (five questions in total, five marks each). Each question should be written in about maximum of 400 words. Parameters to be used for evaluation are as follows:
(i) Content Clarity/Subject Knowledge
(ii) Presentation style
(iii) Organization of content

Part B: Case Study (25 marks)
The students will be given a case study with questions at the end. The students have to analyze the case and answer the question at the end. Parameters to be used for evaluation are as follows:
(i) Analyze the case situation
(ii) Key players/characters of the case
(iii) Identification of the problem (both major & minor if exists)
(iv) Bring out alternatives
(v) Analyze each alternative against the problem
(vi) Choose the best alternative
(vii) Implement as solution
(viii) Conclusion

(ix) Answer the question at the end of the case

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List 'life skills' as identified by WHO
2. What do you mean by effective communication?
3. What are the essential life skills required by a professional?

Course Outcome 2 (CO2)

1. Identify an effective means to deal with workplace stress.
2. How can a student apply journaling to stress management?
3. What is the PATH method? Describe a situation where this method can be used effectively.

Course Outcome 3(CO3):

1. Identify the communication network structure that can be observed in the given situations. Describe them.

   (a) A group discussion on development.

   (b) An address from the Principal regarding punctuality.

   (c) A reporter interviewing a movie star.

   (d) Discussing the answers of a test with a group of friends.

2. Elucidate the importance of non-verbal communication in making a presentation
3. Differentiate between kinesics, proxemics, and chronemics with examples.

Course Outcome 4 (CO4):

1. How can a participant conclude a group discussion effectively?
2. 'Listening skills are essential for effectively participating in a group discussion.' Do you agree? Substantiate your answer.

Course Outcome 5 (CO5):

1. Illustrate the creative thinking process with the help of a suitable example
2. Translate the following problem from verbal to graphic form and find the solution : *In a quiz, Ananth has 50 points more than Bimal, Chinmay has 60 points less than Ananth, and Dharini is 20 points ahead of Chinmay. What is the difference in points between Bimal and Dharini?*

3. List at least five ways in which the problem "How to increase profit?" can be redefined

Course Outcome 6 (CO6):

1. A group of engineers decided to brainstorm a design issue on a new product. Since no one wanted to disagree with the senior members, new ideas were not flowing freely. What group dynamics technique would you suggest to avoid this 'groupthink'? Explain the procedure.
2. "A group focuses on individual contribution, while a team must focus on synergy." Explain.
3. Identify the type of group formed / constituted in each of the given situations

    a) A Police Inspector with subordinates reporting to him

    b) An enquiry committee constituted to investigate a specific incident

    c) The Accounts Department of a company

    d) A group of book lovers who meet to talk about reading

Syllabus

Module 1

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ

Module 2

Self-awareness: definition, need for self-awareness; Coping With Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback.

Stress Management: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion-oriented, acceptance-oriented, resilience, Gratitude Training,

Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques.

Morals, Values and Ethics: Integrity, Civic Virtue, Respect for Others, Living Peacefully. Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Co operation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.

Module 3

21st century skills: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Steps in problem solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.

Module 4

Group and Team Dynamics: Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.

Module 5

Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.

Lab Activities

Verbal

Effective communication and Presentation skills.
Different kinds of communication; Flow of communication; Communication networks, Types of barriers; Miscommunication
Introduction to presentations and group discussions.
Learning styles: visual, aural, verbal, kinaesthetic, logical, social, solitary; Previewing, KWL table, active listening, REAP method
Note-taking skills: outlining, non-linear note-taking methods, Cornell notes, three column note taking.
Memory techniques: mnemonics, association, flashcards, keywords, outlines, spider diagrams and mind maps, spaced repetition.
Time management: auditing, identifying time wasters, managing distractions, calendars and checklists; Prioritizing - Goal setting, SMART goals; Productivity tools and apps, Pomodoro technique.

Non Verbal:
Non-verbal Communication and Body Language: Forms of non-verbal communication; Interpreting body-language cues; Kinesics; Proxemics; Chronemics; Effective use of body language, Communication in a multi cultural environment.

Reference Books

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra, “Personality Development & Soft Skills”, Oxford Publishers, Third impression, 2017.
3. ICT Academy of Kerala, "Life Skills for Engineers", McGraw Hill Education (India) Private Ltd., 2016.
4. Caruso, D. R. and Salovey P, “The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership”, John Wiley & Sons, 2004.
5. Kalyana, “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd, 2015.
6. Larry James, “The First Book of Life Skills”; First Edition, Embassy Books, 2016.
7. Shalini Verma, “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) & Company, 2014.
8. Daniel Goleman, "Emotional Intelligence"; Bantam, 2006.
9. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016.
10. Butterfield Jeff, “Soft Skills for Everyone”, Cengage Learning India Pvt Ltd; 1 edition, 2011.
11. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India; 6 edition, 2015.
12. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.

PHL 120	ENGINEERING PHYSICS LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	0	0	2	1	2019

Preamble: The aim of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to develop practical applications of engineering materials and use the principle in the right way to implement the modern technology.

Prerequisite: Higher secondary level Physics

Course Outcomes: After the completion of the course the student will be able to

CO 1	Develop analytical/experimental skills and impart prerequisite hands on experience for engineering laboratories
CO 2	Understand the need for precise measurement practices for data recording
CO 3	Understand the principle, concept, working and applications of relevant technologies and comparison of results with theoretical calculations
CO 4	Analyze the techniques and skills associated with modern scientific tools such as lasers and fiber optics
CO 5	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				3			1	2			1
CO 2	3				3			1	2			1
CO 3	3				3			1	2			1
CO 4	3				3			1	2			1
CO 5	3				3			1	2			1

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

LIST OF EXPERIMENTS

(Minimum 8 experiments should be completed)

1. CRO-Measurement of frequency and amplitude of wave forms
2. Measurement of strain using strain gauge and wheatstone bridge
3. LCR Circuit – Forced and damped harmonic oscillations
4. Melde's string apparatus- Measurement of frequency in the transverse and longitudinal mode
5. Wave length measurement of a monochromatic source of light using Newton's Rings method.
6. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
7. To measure the wavelength using a millimeter scale as a grating.
8. Measurement of wavelength of a source of light using grating.
9. Determination of dispersive power and resolving power of a plane transmission grating
10. Determination of the particle size of lycopodium powder
11. Determination of the wavelength of He-Ne laser or any standard laser using diffraction grating
12. Calculate the numerical aperture and study the losses that occur in optical fiber cable.
13. I-V characteristics of solar cell.
14. LED Characteristics.
15. Ultrasonic Diffractometer- Wavelength and velocity measurement of ultrasonic waves in a liquid
16. Deflection magnetometer-Moment of a magnet- Tan A position.

Reference books

1. S.L.Gupta and Dr.V.Kumar, "Practical physics with viva voice", Pragati PrakashanPublishers, Revised Edition, 2009

2. M.N.Avadhanulu, A.A.Dani and Pokely P.M, "Experiments in Engineering Physics", S.Chand&Co,2008

3. S. K. Gupta, "Engineering physics practicals", Krishna Prakashan Pvt. Ltd., 2014

4. P. R. Sasikumar "Practical Physics", PHI Ltd., 2011.

CYL 120	ENGINEERING CHEMISTRY LAB	CATEGORY	L	T	P	CREDIT
		BSC	0	0	2	1

Preamble: To impart scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters

Prerequisite: Experiments in chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Understand and practice different techniques of quantitative chemical analysis to generate experimental skills and apply these skills to various analyses
CO 2	Develop skills relevant to synthesize organic polymers and acquire the practical skill to use TLC for the identification of drugs
CO 3	Develop the ability to understand and explain the use of modern spectroscopic techniques for analysing and interpreting the IR spectra and NMR spectra of some organic compounds
CO 4	Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO 5	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
CO 6	Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economical and environmental problems and why it is an integral part of curriculum

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				2							3
CO 2	3				3							3
CO 3	3				3							3
CO 4	3				3							3
CO 5	3				1							3
CO 6	3				1							3

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

LIST OF EXPERIMENTS (MINIMUM 8 MANDATORY)

1. Estimation of total hardness of water-EDTA method
2. Potentiometric titration
3. Determination of cell constant and conductance of solutions.
4. Calibration of pH meter and determination of pH of a solution
5. Estimation of chloride in water
6. Identification of drugs using TLC
7. Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
8. Determination of molar absorptivity of a compound ($KMnO_4$ or any water soluble food colorant)
9. Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
10. Estimation of iron in iron ore
11. Estimation of copper in brass
12. Estimation of dissolved oxygen by Winkler's method
13. (a) Analysis of IR spectra (minimum 3 spectra) (b) Analysis of ^1H NMR spectra (minimum 3 spectra)
14. Flame photometric estimation of Na^+ to find out the salinity in sand
15. Determination of acid value of a vegetable oil
16. Determination of saponification of a vegetable oil

Reference Books

1. G. Svehla, B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson, 2012.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning, 2017.
3. Muhammed Arif, "Engineering Chemistry Lab Manual", Owl publishers, 2019.
4. Ahad J., "Engineering Chemistry Lab manual", Jai Publications, 2019.
5. Roy K Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers, 2019.
6. Soney C George, Rino Laly Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company Pvt Ltd, New Delhi, 2019.

ESL 120	CIVIL & MECHANICAL WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
			0	0	2	1	2019

Preamble: The course is designed to train the students to identify and manage the tools, materials and methods required to execute an engineering project. Students will be introduced to a team working environment where they develop the necessary skills for planning, preparing and executing an engineering project.

To enable the student to familiarize various tools, measuring devices, practices and different methods of manufacturing processes employed in industry for fabricating components.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to:

Course Outcome	Course Outcome Description
CO 1	Name different devices and tools used for civil engineering measurements
CO 2	Explain the use of various tools and devices for various field measurements
CO 3	Demonstrate the steps involved in basic civil engineering activities like plot measurement, setting out operation, evaluating the natural profile of land, plumbing and undertaking simple construction work.
CO 4	Choose materials and methods required for basic civil engineering activities like field measurements, masonry work and plumbing.
CO 5	Compare different techniques and devices used in civil engineering measurements
CO 6	Identify Basic Mechanical workshop operations in accordance with the material and objects
CO 7	Apply appropriate Tools and Instruments with respect to the mechanical workshop trades
CO 8	Apply appropriate safety measures with respect to the mechanical workshop trades

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	-	-	-	1	1	-	-	2	2	-	-
CO 2	1	-	-	-	1	1	-	-	2	2	-	-
CO 3	1	-	-	-	1	1	-	2	2	2	1	-
CO 4	1	-	-	-	1	1	-	2	2	2	1	1
CO 5	1	-	-	-	1	1	-	-	2	2		1
CO 6	2											

CO 7	2											
CO 8	2											

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hour

Assessment Procedure: Total marks allotted for the course is 100 marks. CIE shall be conducted for 70 marks and ESE for 30 marks. CIE should be done for the work done by the student and also viva voce based on the work done on each practical session. ESE shall be evaluated by written examination of one hour duration conducted internally by the institute.

Continuous Internal Evaluation Pattern:

Attendance : 20 marks
Class work/ Assessment /Viva-voce : 50 marks
End semester examination (Internally by college) : 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

PART 1

CIVIL WORKSHOP

Exercise 1. Calculate the area of a built-up space and a small parcel of land- Use standard measuring tape and digital distance measuring devices

Exercise 2. (a) Use screw gauge and vernier calliper to measure the diameter of a steel rod and thickness of a flat bar

(b) Transfer the level from one point to another using a water level

(c) Set out a one room building with a given plan and measuring tape

Exercise 3. Find the level difference between any two points using dumpy level

Exercise 4. (a) Construct a $1\frac{1}{2}$ thick brick wall of 50 cm height and 60 cm length using English bond. Use spirit level to assess the tilt of walls.

(b) Estimate the number of different types of building blocks to construct this wall.

Exercise 5. (a) Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves ,fixtures and sanitary fittings.

(b) Install a small rainwater harvesting installation in the campus

Reference Books:

1. Khanna P.N, "Indian Practical Civil Engineering Handbook", Engineers Publishers.
2. Bhavikatti. S, "Surveying and Levelling (Volume 1)", I.K. International Publishing House
3. Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications
4. S. C. Rangwala, "Engineering Materials," Charotar Publishing House.

PART II

MECHANICAL WORKSHOP

LIST OF EXERCISES

(Minimum EIGHT units mandatory and FIVE models from Units 2 to 8 mandatory)

UNIT 1:- General : Introduction to workshop practice, Safety precautions, Shop floor ethics, Basic First Aid knowledge.

Study of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc.

UNIT 2:- Carpentry : Understanding of carpentry tools

Minimum any one model

1. T –Lap joint 2. Cross lap joint 3. Dovetail joint 4. Mortise joints

UNIT 3:- Foundry : Understanding of foundry tools

Minimum any one model

1.Bench Molding 2. Floor Molding 3. Core making 4. Pattern making

UNIT 4: - Sheet Metal : Understanding of sheet metal working tools

Minimum any one model

1. Cylindrical shape
2. Conical shape
3. Prismatic shaped job from sheet metal

UNIT 5: - Fitting : Understanding of tools used for fitting

Minimum any one model

1. Square Joint
2. V- Joint
3. Male and female fitting

UNIT 6: - Plumbing : Understanding of plumbing tools, pipe joints

Any one exercise on joining of pipes making use of minimum three types of pipe joints

UNIT 7: - Smithy: Understanding of tools used for smithy.

Demonstrating the forge-ability of different materials (MS, Al, alloy steel and cast steels) in cold and hot states.

Observing the qualitative difference in the hardness of these materials

Minimum any one exercise on smithy

1. Square prism
2. Hexagonal headed bolt
3. Hexagonal prism
4. Octagonal prism

UNIT 8: -Welding: Understanding of welding equipments

Minimum any one welding practice

Making Joints using electric arc welding. bead formation in horizontal, vertical and over head positions

UNIT 9: - Assembly: Demonstration only

Dissembling and assembling of

1. Cylinder and piston assembly
2. Tail stock assembly
3. Bicycle
4. Pump or any other machine

UNIT 10: - Machines: Demonstration and applications of the following machines

Shaping and slotting machine; Milling machine; Grinding Machine; Lathe; Drilling Machine.

UNIT 11: - Modern manufacturing methods: Power tools, CNC machine tools, 3D printing, Glass cutting.

Course Contents and Lecture Schedule:

No	Topic	No of Sessions
1	**INTRODUCTION**	
1.1	Workshop practice, shop floor precautions, ethics and First Aid knowledge. Studies of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc	1
2	**CARPENTRY**	
2.1	Understanding of carpentry tools and making minimum one model	2

3	**FOUNDRY**	
3.1	Understanding of foundry tools and making minimum one model	2
4	**SHEET METAL**	
4.1	Understanding of sheet metal working tools and making minimum one model	2
5	**FITTING**	
5.1	Understanding of fitting tools and making minimum one model	2
6	**PLUMBING**	
6.1	Understanding of pipe joints and plumbing tools and making minimum one model	2
7	**SMITHY**	
7.1	Understanding of smithy tools and making minimum one model	2
8	**WELDING**	
8.1	Understanding of welding equipments and making minimum one model	2
9	**ASSEMBLY**	
9.1	Demonstration of assembly and dissembling of multiple parts components	1
10	**MACHINES**	
10.1	Demonstration of various machines	1
11	**MODERN MANUFACTURING METHODS**	
11.1	Demonstrations of: power tools, CNC Machine tools, 3D printing, Glass cutting	1

ESL 130	ELECTRICAL & ELECTRONICS WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	0	0	2	1	2019

Preamble: Electrical Workshop is intended to impart skills to plan and carry out simple electrical wiring. It is essential for the practicing engineers to identify the basic practices and safety measures in electrical wiring.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Demonstrate safety measures against electric shocks.
CO 2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols
CO 3	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings
CO 4	Identify and test various electronic components
CO 5	Draw circuit schematics with EDA tools
CO 6	Assemble and test electronic circuits on boards
CO 7	Work in a team with good interpersonal skills

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	3	-	-	-	-	-	1
CO 2	2	-	-	-	-	-	-	-	-	1	-	-
CO 3	2	-	-	1	-	1	-	1	2	2	-	2
CO 4	3	-	-	-	-	-	-	-	-	-	-	2
CO 5	3	-	-	-	2	-	-	-	-	-	-	2
CO 6	3	-	-	-	2	-	-	-	-	-	-	1
CO 7	-	-	-	-	-	-	-	-	3	2	-	2

Mark distribution

Total Marks	CIE	ESE	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

Syllabus

PART 1

ELECTRICAL

List of Exercises / Experiments

1. a) Demonstrate the precautionary steps adopted in case of Electrical shocks.
   b)Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.
2. Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)
3. Wiring of light/fan circuit using Two way switches . (Staircase wiring)
4. Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6. a)Identify different types of batteries with their specifications.
   b)Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.

PART II

ELECTRONICS

List of Exercises / Experiments (Minimum of 7 mandatory)

1. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)

2. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as Dia or XCircuit), Interpret data sheets of discrete components and IC's, Estimation and costing.

3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station etc.]

4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]

5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]

6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]
7. Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
8. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning (**Any Two circuits).**

    1. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
    2. Square wave generation using IC 555 timer in IC base.
    3. Sine wave generation using IC 741 OP-AMP in IC base.
    4. RC coupled amplifier with transistor BC107.

SEMESTER II

MAT 102	VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: This course introduces the concepts and applications of differentiation and integration of vector valued functions, differential equations, Laplace and Fourier Transforms. The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include the Calculus of vector valued functions, ordinary differential equations and basic transforms such as Laplace and Fourier Transforms which are invaluable for any engineer's mathematical tool box. The topics treated in this course have applications in all branches of engineering.

Prerequisite: Calculus of single and multi variable functions.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the derivatives and line integrals of vector functions and learn their applications
CO 2	Evaluate surface and volume integrals and learn their inter-relations and applications.
CO 3	Solve homogeneous and non-homogeneous linear differential equation with constant coefficients
CO 4	Compute Laplace transform and apply them to solve ODEs arising in engineering
CO 5	Determine the Fourier transforms of functions and apply them to solve problems arising in engineering

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	1			1	2		2
CO 2	3	3	3	3	2	1			1	2		2
CO 3	3	3	3	3	2	1			1	2		2
CO 4	3	3	3	3	2	1			1	2		2
CO 5	3	3	3	3	2	1			1	2		2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks	Test 2 (Marks)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			

Create			

Mark distribution

Total Marks	**CIE** (Marks)	**ESE** (Marks)	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

Assignments: Assignment should include specific problems highlighting the applications of the methods introduced in this course in science and engineering.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1): Compute the derivatives and line integrals of vector functions and learn their applications

1. How would you calculate the speed, velocity and acceleration at any instant of a particle moving in space whose position vector at time $t$is $\boldsymbol{r}(t)$?

2. Find the work done by the force field $F = (e^x - y^3)\boldsymbol{i} + (\cos y + x^3)$on a particle that travels once around the unit circle centred at origin having radius 1.

3. When do you say that a vector field is conservative? What are the implications if a vector field is conservative?

Course Outcome 2 (CO2): Evaluate surface and volume integrals and learn their inter-relations and applications

1. Write any one application each of line integral, double integral and surface integral.

2. Use the divergence theorem to find the outward flux of the vector field $F(x, y, z) = z\boldsymbol{k}$across the

$$x^2 + y^2 + z^2 = a^2$$

3. State Greens theorem. Use Green's theorem to express the area of a plane region bounded by a curve as a line integral.

Course Outcome 3 (CO3): Solve homogeneous and non-homogeneous linear differential equation with constant coefficients

1. If $y_1(x)$ and $y_2(x)$ are solutions of$y'' + py' + qy = 0$, where p, q are constants, show that

   $y_1(x) + y_2(x)$ is also a solution.

2. Solve the differential equation $y'' + y = 0.001x^2$ using method of undetermined coefficient.

3. Solve the differential equation of$y''' - 3y'' + 3y' - y = e^x - x - 1$.

Course Outcome 4 (CO4): Compute Laplace transform and apply them to solve ODEs arising in engineering

1. What is the inverse Laplace Transformof $(s) = \frac{3s-137}{s^2+2s+4}$?

2. Find Laplace Transform of Unit step function.

3. Solve the differential equation of $y'' + 9y = \delta\left(t - \frac{\pi}{2}\right)$? Given $y(0) = 2,\ y'(0) = 0$

Course Outcome 5(CO5): Determine the Fourier transforms of functions and apply them to solve problems arising in engineering

1. Find the Fourier integral representation of function defined by
   $f(x) = e^{-x}$for$x > 0$ and $f(x) = 0$for$x < 0$.

2. What are the conditions for the existence of Fourier Transform of a function $f(x)$?

3. Find the Fourier transform of $f(x) = 1$ for $|x| < 1$ and $f(x) = 0$ otherwise.

Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MAT 102

Max. Marks: 100 **Duration: 3 Hours**

VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS

(2019-Scheme)

(Common to all branches)

PART A

(Answer all questions. Each question carries 3 marks)

1. Is the vector $\boldsymbol{r}$ **where** $\boldsymbol{r} = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$ conservative. Justify your answer.
2. State Greens theorem including all the required hypotheses
3. What is the outward flux of $\boldsymbol{F}(\boldsymbol{x}, \boldsymbol{y}, \boldsymbol{z}) = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$ across any unit cube**.**
4. What is the relationship between Green's theorem and Stokes theorem?
5. Solve $y'' + 4y' + 2.5y = 0$
6. Does the function $y = C_1 \cos x + C_2\, sinx$form a solution of$y'' + y = 0$?. Is it the general solution? Justify your answer.
7. Find the Laplace transform of $e^{-t} \sinh 4t$
8. Find the Laplace inverse transform of $\frac{1}{s\,(s^2+\omega^2)}$**.**
9. Given the Fourier transform $\frac{1}{\sqrt{2}} e^{-\frac{\omega^2}{4}}$ of $f(x) = e^{-x^2}$, find the Fourier transform of xe^{-x^2}
10. State the convolution theorem for Fourier transform

PART B

(Answer one full question from each module. Each full question carries 14 marks)

MODULE 1

11a) Prove that the force field $\boldsymbol{F} = e^y\boldsymbol{i} + xe^y\boldsymbol{j}$is conservative in the entire xy-plane

b**)** Use Greens theorem to find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

12 a) Find the divergence of the vector field$\boldsymbol{F} = \frac{c}{(\boldsymbol{x^2+y^2+z^2})^{3/2}}(x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k})$

b) Find the work done by the force field$\boldsymbol{F}(x, y, z) = xy\boldsymbol{i} + yz\boldsymbol{j} + xz\boldsymbol{k}$along C where

C is the curve$\boldsymbol{r}(t) = t\boldsymbol{i} + t^2\boldsymbol{j} + t^3\boldsymbol{k}$

MODULE II

13 a) Use divergence theorem to find the outward flux of the vector field

$\boldsymbol{F} = 2x\boldsymbol{i} + 3y\boldsymbol{j} + z^3\boldsymbol{k}$acrossthe unit cube bounded by or $x = 0$, $y = 0$,$z = 0$,$x = 1$,$y = 1$,$z = 1$

b) Find the circulation of $\boldsymbol{F} = (x - z)\boldsymbol{i} + (y - x)\boldsymbol{j} + (\boldsymbol{z} - \boldsymbol{xy})\boldsymbol{k}$ using Stokes theorem around the triangle with vertices $A(1,0,0)$, $B(0,2,0)$and $C(0,0,1)$

14 a**)** Use divergence theorem to find the volume of the cylindrical solid bounded by $x^2 + 4x + y^2 = 7$, $z = -1$, $z = 4$, given the vector field $\boldsymbol{F} = \boldsymbol{x}i + \boldsymbol{y}j + \boldsymbol{z}k$ across surfaceof the cylinder

b) Use Stokes theorem to evaluate$\int_C \boldsymbol{F}.\boldsymbol{dr}$where$\boldsymbol{F} = x^2\boldsymbol{i} + 3x\boldsymbol{j} - y^3\boldsymbol{k}$where Cis

the circle $x^2 + y^2 = 1$ in the xy- plane with counterclockwise orientation looking down the positive z-axis

MODULE III

15 a) Solve $y'' + 4y' + 4y = x^2 + e^{-x}\cos x$

b) Solve $y''' - 3y'' + 3y' - y = e^x - x - 1$

16 a) Solve $y''' + 3y'' + 3y' + y = 30e^{-x}$ given $y(0) = 3, y'(0) = -3$, $y''(0) = -47$

b) Using method of variation of parameters, solve $y'' + y = sec\ x$

MODULE IV

17 a) Find the inverse Laplace transform of $F(s) = \frac{2(e^{-s} - e^{-3s})}{s^2 - 4}$

b) Solve the differential equation $y'' + 16y = 4\delta(t - 3\pi);\ y(0) = 2, y'(0) = 0$ using Laplace transform

18 a) Solve $y'' + 3y' + 2y = f(t)$ where $f(t) = 1$ for $0 < t < 1$ and $f(t) = 1$ for $t > 1$ using Laplace transform

b) Apply convolution theorem to find the Laplace inverse transform of $\frac{1}{s^2(s^2 + \omega^2)}$

MODULE V

19 a) Find the Fourier cosine integral representation for $f(x) = e^{-kx}$ for $x > 0$ and $k > 0$ and hence evaluate $\int_0^\infty \frac{\cos wx}{k^2 + w^2}$ the function

b) Does the Fourier sine transform $f(x) = x^{-1}\sin x$ for $0 < x < \infty$ exist? Justify your answer

20 a) Find the Fourier transform of $f(x) = |x|$ for $|x| < 1$ and $f(x) = 0$ otherwise

b) Find the Fourier cosine transform of $f(x) = e^{-ax}$ for a> 0

Syllabus

Module 1 (Calculus of vector functions)

(Text 1: Relevant topics from sections 12.1, 12.2, 12.6, 13.6, 15.1, 15.2, 15.3)

Vector valued function of single variable, derivative of vector function and geometrical interpretation, motion along a curve-velocity, speed and acceleration. Concept of scalar and vector fields , Gradient and its properties, directional derivative , divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields , independence of path and potential function(results without proof).

Module 2 (Vector integral theorems)

(Text 1: Relevant topics from sections 15.4, 15.5, 15.6, 15.7, 15.8)

Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Surface integrals over surfaces of the form z = g(x, y), y = g(x, z) or x = g(y, z) , Flux integrals over surfaces of the form z = g(x, y), y = g(x, z) or x = g(y, z), divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done.

Module- 3 (Ordinary differential equations)

(Text 2: Relevant topics from sections 2.1, 2.2, 2.5, 2.6, 2.7, 2.10, 3.1, 3.2, 3.3)

Homogenous linear differential equation of second order, superposition principle,general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order only).Existence and uniqueness (without proof). Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients (for the right hand side of the form x^n,e^{kx},$sinax$,$cosax$,$e^{kx}sinax$$e^{kx}cosax$and their linear combinations), methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficient using method of undetermined coefficient.

Module- 4 (Laplace transforms)

(Text 2: Relevant topics from sections 6.1,6.2,6.3,6.4,6.5)

Laplace Transform and its inverse ,Existence theorem (without proof) , linearity,Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Dirac delta function and its Laplace transform, Solution of ordinary differential equation involving unit step function and Dirac delta functions. Convolution theorem(without proof)and its application to finding inverse Laplace transform of products of functions.

Module-5 (Fourier Tranforms)

(Text 2: Relevant topics from sections 11.7,11.8, 11.9)

Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties. The Fourier transform of derivatives. Convolution theorem (without proof)

Text Books

1. H. Anton, I. Biven S.Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 10th edition, 2015.

Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson,Reprint, 2002.
3. Peter O Neil, Advanced Engineering Mathematics, 7th Edition, Thomson, 2007.
4. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6th edition, 2003.
5. VeerarajanT."Engineering Mathematics for first year", Tata McGraw - Hill, 2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th edition , 2010.
7. Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 2015.
8. Ronald N. Bracewell, "The Fourier Transform and its Applications", McGraw – Hill International Editions, 2000.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Calculus of vector functions** (**9 hours**)	
1.1	Vector valued function of a scalar variable - derivative of vector valued function of scalar variable t-geometrical meaning	2
1.2	Motion along a curve-speed , velocity, acceleration	1
1.3	Gradient and its properties, directional derivative , divergent and curl	3
1.4	Line integrals with respect to arc length, line integrals of vector fields. Work done as line integral	2
1.5	Conservative vector field, independence of path, potential function	1

2	**Vector integral theorems(9 hours)**	
2.1	Green's theorem and it's applications	2
2.2	Surface integrals , flux integral and their evaluation	3
2.3	Divergence theorem and applications	2
2.4	Stokes theorem and applications	2
3	**Ordinary Differential Equations (9 hours)**	
3.1	Homogenous linear equation of second order, Superposition principle, general solution	1
3.2	Homogenous linear ODEs of second order with constant coefficients	2
3.3	Second order Euler-Cauchy equation	1
3.4	Non homogenous linear differential equations of second order with constant coefficient-solution by undetermined coefficients, variation of parameters.	3
3.5	Higher order equations with constant coefficients	2
4	**Laplace Transform (10 hours)**	
4.1	Laplace Transform , inverse Transform, Linearity, First shifting theorem, transform of basic functions	2
4.2	Transform of derivatives and integrals	1
4.3	Solution of Differential equations, Initial value problems by Laplace transform method.	2
4.4	Unit step function --- Second shifting theorem	2
4.5	Dirac Delta function and solution of ODE involving Dirac delta function	2
4.6	Convolution and related problems.	1
5	**Fourier Transform (8 hours)**	
5.1	Fourier integral representation	1
5.2	Fourier Cosine and Sine integrals and transforms	2
5.3	Complex Fourier integral representation, Fourier transform and its inverse transforms, basic properties	3
5.4	Fourier transform of derivatives, Convolution theorem	2

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY
KTU

PHT 100	ENGINEERING PHYSICS A (FOR CIRCUIT BRANCHES)	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics Program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Classify the properties of magnetic materials and apply vector calculus to static magnetic fields and use Maxwell's equations to diverse engineering problems
CO 5	Analyze the principles behind various superconducting applications, explain the working of solid state lighting devices and fibre optic communication system

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3	1						1	2			1
CO 5	3	1						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20

Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.

   (b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.

   (b) A liquid of refractive index μ is introduced between the lens and glass plate.

What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function ?

2. What are excitons ?

3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.

(b) Calculate the first three energy values of an electron in a one dimensional box of width 1 A^0 in electron volt.

Course Outcome 4 (CO4):

1. Compare displacement current and conduction current.

2. Mention any four properties of ferro magnetic materials.

3. (a) Starting from Maxwell's equations, derive the free space electromagnetic wave equation and show that velocity of electromagnetic wave is $1/ (\mu_o \varepsilon_o)^{½}$

(b) An electromagnetic wave is described by $E = 100 \exp 8\pi i [10^{14} t – (10^6 z / 3)]$ V/m. Find the direction of propagation of the wave,speed of the wave and magnetic flux density in the wave.

Course Outcome 5 (CO5):

1. Explain the working of a solar cell.

2. Distinguish between Type I and Type II super conductors.

3. (a) Define numerical aperture and derive an expression for it.

(b) Explain the working of intensity modulated fibre optic sensor.

Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: PHT 100

Course Name: Engineering Physics A

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators
2. Distinguish between longitudinal and transverse waves
3. Write a short note on antireflection coating.
4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.
5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.
6. Explain surface to volume ratio of nanomaterials.
7. State Faraday's laws of electromagnetic induction.
8. Compare displacement current and conduction current
9. List four important applications of superconductors.
10. Give the working principle of LED. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution.Discuss the cases of over damped, critically damped and under damped cases. (10)

(b) The frequency of a tuning fork is 500 Hz and its Q factor is $7\times10^{4.}$ Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value.(4)

12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by y =0.00327 sin (72.1x-2.72t)m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv)Velocity of the wave. (4)

Module 2

13.(a)Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid. (10)

(b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength 4800Å. Given β = 0.0555 cm. (4)

14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)

(b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15.(a) Derive time dependent and independent Schrodinger equations. (10)

(b) An electron is confined to one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16.(a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)

(b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17.(a) State Poynting's Theorem. Calculate the value of Poynting vector at the surface of the sun if the power radiated by the sun is 3.8×10^{26} W and its radius is 7×10^{8} m. (5)

(b) Distinguish between paramagnetic, diamagnetic and ferromagnetic materials. (9)

18.(a) Starting from Maxwell's Equations, derive electromagnetic wave equations in free space. (10)

(b) If the magnitude of **H** in a plane wave is 1 A/m, find the magnitude of **E** in free space. (4)

Module 5

19.(a) Show that superconductors are perfect diamagnets. Distinguish between Type I and Type II superconductors with suitable examples. (10)

(b) Write a short note on high temperature superconductors. (4)

20.(a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33. (4) (14x5=70)

Syllabus

ENGINEERING PHYSICS A
(FOR CIRCUIT BRANCHES)

Module 1

Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2

Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3

Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4

Magnetism & Electro Magnetic Theory

Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux, Magnetic permeability and susceptibility, Classification of magnetic materials-para, dia and ferromagnetic materials

Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem, Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)

Module 5

Superconductivity & Photonics

Superconducting phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II, BCS Theory (Qualitative), High temperature superconductors-Applications of super conductivity

Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics, Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors.

Text Books

1. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition 2019

2. H.K.Malik , A.K. Singh, "Engineering Physics" McGraw Hill Education, Second Edition 2017

Reference Books

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2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007
7. Halliday, Resnick, Walker, "Fundamentals of Physics'', John Wiley & Sons.Inc, 2001
8. David J Griffiths, "Introduction to Electrodynamics'', Addison-Wesley publishing, 3rd Edition, 1999
9. Premlet B., "Advanced Engineering Physics", Phasor Books,10th edition,2017
10. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Oscillations and Waves (9 hours)**	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves. Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	**Wave Optics (9 hours)**	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hr
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	**Quantum Mechanics &Nanotechnology (9hours)**	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	**Magnetism & Electro Magnetic Theory (9 hours)**	
4.1	Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux	2 hrs

	density, Ampere's Circuital law, Faraday's law in terms of EMF produced by changing magnetic flux	
4.2	Explanation for Magnetic permeability and susceptibility Classification of magnetic materials- para, dia and ferromagnetic materials	1 hr
4.3	Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, Line, Surface and Volume integrals, Gauss divergence theorem & Stokes' theorem	2 hrs
4.4	Equation of continuity, Derivation of Maxwell's equations in vacuum, Comparison of displacement current with conduction current. Electromagnetic waves, Velocity of Electromagnetic waves in free space, Flow of energy and Poynting's vector (no derivation)	4 hrs
5	**Superconductivity &Photonics (9hours)**	
5.1	Super conducting Phenomena, Meissner effect and perfect diamagnetism, Types of superconductors-Type I and Type II	2 hrs
5.2	BCS Theory (Qualitative), High temperature superconductors, Applications of super conductivity	2 hrs
5.3	Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics	2 hrs
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

PHT 110	ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)	Category	L	T	P	CREDIT	Year of Introduction
		BSC	3	1	0	4	2019

Preamble: The aim of the Engineering Physics program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

Prerequisite: Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

Course Outcomes: After the completion of the course the student will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments.
CO 3	Analyze the behaviour of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.
CO 4	Apply the knowledge of ultrasonics in non-destructive testing and use the principles of acoustics to explain the nature and characterization of acoustic design and to provide a safe and healthy environment
CO 5	Apply the comprehended knowledge about laser and fibre optic communication systems in various engineering applications

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2						1	2			1
CO 2	3	2						1	2			1
CO 3	3	2						1	2			1
CO 4	3							1	2			1
CO 5	3	2						1	2			1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50

Apply	10	10	20
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE MARKS	ESE MARKS	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the effect of damping force on oscillators.
2. Distinguish between transverse and longitudinal waves.
3. (a) Derive an expression for the fundamental frequency of transverse vibration in a stretched string.
   (b) Calculate the fundamental frequency of a string of length 2 m weighing 6 g kept stretched by a load of 600 kg.

Course Outcome 2 (CO2):

1. Explain colours in thin films.
2. Distinguish between Fresnel and Fraunhofer diffraction.
3. (a) Explain the formation of Newton's rings and obtain the expression for radii of bright and dark rings in reflected system. Also explain how it is used to determine the wavelength of a monochromatic source of light.
   (b) A liquid of refractive index μ is introduced between the lens and glass plate. What happens to the fringe system? Justify your answer.

Course Outcome 3 (CO3):

1. Give the physical significance of wave function?

2. What are excitons ?

3. (a) Solve Schrodinger equation for a particle in a one dimensional box and obtain its energy eigen values and normalised wave functions.

(b) Calculate the first three energy values of an electron in a one dimensional box of width 1 A^0 in electron volt.

Course Outcome 4 (CO4):

1. Explain reverberation and reverberation time.
2. How ultrasonic waves are used in non-destructive testing.
3. (a) With a neat diagram explain how ultrasonic waves are produced by a piezoelectric oscillator.

(b) Calculate frequency of ultrasonic waves that can be produced by a nickel rod of length 4 cm. (Young's Modulus = 207 G Pa, Density = 8900 Kg /m^3)

Course Outcome 5 (CO 5):

1. Distinguish between spontaneous emission and stimulated emission.
2. Explain optical resonators.
3. (a) Explain the construction and working of Ruby Laser.

(b) Calculate the numerical aperture and acceptance angle of a fibre with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fibre is inside water of refractive index 1.33.

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Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: PHT 110

Course Name: Engineering Physics B

Max.Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Compare electrical and mechanical oscillators.

2. Distinguish between longitudinal and transverse waves.

3. Write a short note on antireflection coating.

4. Diffraction of light is not as evident in daily experience as that of sound waves. Give reason.

5. State and explain Heisenberg's Uncertainty principle. With the help of it explain natural line broadening.

6. Explain surface to volume ratio of nanomaterials.

7. Define sound intensity level. Give the values of threshold of hearing and threshold of pain.

8. Describe the method of non-destructive testing using ultra sonic waves

9. Explain the condition of population inversion

10. Distinguish between step index and graded index fibre. (10x3=30)

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Derive the differential equation of damped harmonic oscillator and deduce its solution. Discuss the cases of over damped, critically damped and under damped cases. (10)

(b) The frequency of a tuning fork is 500 Hz and its Q factor is $7\times10^{4.}$ Find the relaxation time. Also calculate the time after which its energy becomes 1/10 of its initial undamped value. (4)

12. (a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. Deduce laws of transverse vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by y =0.00327 sin (72.1x-2.72t) m, in which the numerical constants are in S.I units. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv) Velocity of the wave. (4)

Module 2

13. (a) Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid? (10)

(b) Two pieces of plane glass are placed together with a piece of paper between two at one end. Find the angle of the wedge in seconds if the film is viewed with a monochromatic light of wavelength 4800Å. Given $\beta = 0.0555$ cm. (4)

14. (a) Explain the diffraction due to a plane transmission grating. Obtain the grating equation. (10)

(b) A grating has 6000 lines per cm. Find the angular separation of the two yellow lines of mercury of wavelengths 577 nm and 579 nm in the second order. (4)

Module 3

15. (a) Derive time dependent and independent Schrodinger equations. (10)

(b) An electron is confined to one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16. (a) Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) nano sheets (ii) nano wires (iii) quantum dots. (10)

(b) Find the de Broglie wavelength of electron whose kinetic energy is 15 eV. (4)

Module 4

17. (a) Explain reverberation and reverberation time? What is the significance of Reverberation time. Explain the factors affecting the acoustics of a building and their corrective measures? (10)

(b) The volume of a hall is 3000 m^3. It has a total absorption of 100m^2 sabine. If the hall is filled with audience who add another 80 m^2sabine, then find the difference in reverberation time. (4)

18. (a) With a neat diagram explain how ultrasonic waves are produced by piezoelectric oscillator. Also discuss the piezoelectric method of detection of ultrasonic waves. (10)

(b) An ultrasonic source of 0.09 MHz sends down a pulse towards the sea bed which returns after 0.55 sec. The velocity of sound in sea water is 1800 m/s. Calculate the depth of the sea and the wavelength of the pulse. (4)

Module 5

19. (a) Outline the construction and working of Ruby laser. (8)

(b) What is the principle of holography? How is a hologram recorded? (6)

20. (a) Define numerical aperture of an optic fibre and derive an expression for the NA of a step index fibre with a neat diagram. (10)

(b) An optical fibre made with core of refractive index 1.5 and cladding with a fractional index difference of 0.0006. Find refractive index of cladding and numerical aperture. (4)

(14x5=70)

SYLLABUS

ENGINEERING PHYSICS B (FOR NON-CIRCUIT BRANCHES)

Module 1

Oscillations and Waves

Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression, Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators

Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration

Module 2

Wave Optics

Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference, Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings

Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)

Module 3

Quantum Mechanics & Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening Mechanism, Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)

Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots, Properties of nanomaterials-mechanical, electrical and optical, Applications of nanotechnology (qualitative ideas)

Module 4

Acoustics & Ultrasonics

Acoustics, Classification of sound-Musical sound-Noise, Characteristics of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation), Factors affecting architectural acoustics and their remedies

Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator –Working, Detection of ultrasonic waves - Thermal and Piezoelectric

methods, Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid , Applications of ultrasonic waves -SONAR,NDT and Medical

Module 5

Laser and Fibre optics

Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle, Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) ,Applications of laser, Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications

Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors

Text Books

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3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. Ajoy Ghatak, "Optics", Mc Graw Hill Education, Sixth Edition, 2017
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007
7. B. B. Laud, "Lasers and Non linear optics", New age International Publishers, 2nd Edition ,2005
8. Premlet B., "Advanced Engineering Physics", Phasor Books,10th edition ,2017
9. I. Dominic and. A. Nahari, "A Text Book of Engineering physics", Owl Books Publishers, Revised edition, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Oscillations and Waves (9 hours)**	
1.1	Harmonic oscillations, Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases, Quality factor-Expression	2 hrs
1.2	Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators	3hrs
1.3	Wave motion- Derivation of one dimensional wave equation and its solution, Three dimensional wave equation and its solution (no derivation)	2 hrs
1.4	Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration	2 hrs
2	**Wave Optics (9 hours)**	
2.1	Interference of light-Principle of superposition of waves, Theory of thin films - Cosine law (Reflected system), Derivation of the conditions of constructive and destructive Interference	2 hrs
2.2	Interference due to wedge shaped films -Determination of thickness and test for optical planeness, Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings	4 hrs
2.3	Diffraction of light, Fresnel and Fraunhofer classes of diffraction, Diffraction grating-Grating equation	2 hrs
2.4	Rayleigh criterion for limit of resolution, Resolving and Dispersive power of a grating with expression (no derivation)	1 hr
3	**Quantum Mechanics &Nanotechnology (9hours)**	
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism	2 hrs
3.2	Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function, Particle in a one dimensional box- Derivation for normalised wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)	4 hrs
3.3	Introduction to nanoscience and technology, Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nano wires and Quantum dots	2 hrs
3.4	Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)	1 hr
4	**Acoustics & Ultrasonics (9hrs)**	
4.1	Acoustics, Classification of sound-Musical sound-Noise, Characteristics	3 hrs

	of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation)	
4.2	Factors affecting architectural acoustics and their remedies	1 hr
4.3	Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator – Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods	3hrs
4.4	Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid ,Applications of ultrasonic waves -SONAR,NDT and Medical.	2 hr
5	**Laser and Fibre optics (9hours)**	
5.1	Properties of laser, Absorption and emission of radiation, Spontaneous and stimulated emission, Einstein's coefficients (no derivation), Population inversion, Metastable states, basic components of laser, Active medium, Pumping mechanism, Optical resonant cavity, working principle	2 hrs
5.2	Construction and working of Ruby laser and Helium neon laser ,Construction and working of semiconductor laser(Qualitative) Applications of laser	3 hrs
5.3	Holography, Difference between hologram and photograph, Recording of hologram and reconstruction of image, Applications	1 hr
5.4	Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications, Fibre optic sensors-Intensity Modulated and Phase modulated sensors	3 hrs

CYT 100	ENGINEERING CHEMISTRY	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	3	1	0	4	2019

Preamble: To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like spectroscopy, electrochemistry, instrumental methods etc. Also familiarize the students with topics like mechanism of corrosion, corrosion prevention methods, SEM, stereochemistry, polymers, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of chemistry.

Prerequisite: Concepts of chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Apply the basic concepts of electrochemistry and corrosion to explore its possible applications in various engineering fields.
CO 2	Understand various spectroscopic techniques like UV-Visible, IR, NMR and its applications.
CO 3	Apply the knowledge of analytical method for characterizing a chemical mixture or a compound. Understand the basic concept of SEM for surface characterisation of nanomaterials.
CO 4	Learn about the basics of stereochemistry and its application. Apply the knowledge of conducting polymers and advanced polymers in engineering.
CO 5	Study various types of water treatment methods to develop skills for treating wastewater.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1									
CO 2	1	1		1	2							
CO 3	1	1		1	2							
CO 4	2	1										
CO 5	1			1			3					

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			
Create			

End Semester Examination Pattern: There will be two parts- **Part A** and **Part B. Part A** contains **10** questions (**2** questions from each module), having **3** marks for each question. Students should answer **all** questions. **Part B** contains **2** questions from each module, of which student should answer any one. Each question can have maximum **2** subdivisions and carries **14** marks.

Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. What is calomel electrode? Give the reduction reaction (3 Marks)

2. List three important advantages of potentiometric titration (3 Marks)

3. (a) Explain how electroless plating copper and nickel are carried out (10 Marks)

(b) Calculate the emf of the following cell at 30°C, Z n / Zn^{2+} (0.1M) // Ag^{+} (0.01M) // Ag.

Given E^0 Zn^{2+}/Zn = -0.76 V, E^0 Ag^{+}/Ag = 0.8 V. (4 Marks)

Course Outcome 2 (CO 2)

1. State Beer Lambert's law (3 Marks)

2. List the important applications of IR spectroscopy (3 Marks)

3. (a) What is Chemical shift? What are factors affecting Chemical shift? How ^1H NMR spectrum of CH_3COCH_2Cl interpreted using the concept of chemical shift. (10 Marks)

(b) Calculate the force constant of HF molecule, if it shows IR absorption at 4138 cm^{-1}. Given that atomic masses of hydrogen and fluorine are 1u and 19u respectively. (4 Marks)

Course Outcome 3 (CO 3):

1. Distinguish between TGA and DTA (3 Marks)

2. Give two differences between GSC and GLC (3 Marks)

3. (a) Explain the principle, instrumentation and procedure of HPLC (10 Marks)

(b) Interpret TGA of $CaC_2O_4 . H_2O$ (4 Marks)

Course Outcome 4 (CO 4):

1. Explain the geometrical isomerism in double bonds (3 Marks)

2. What are the rules of assigning R-S notation? (3 Marks)

3. (a) What are conducting polymers? How it is classified? Give the preparation of polyaniline (10 Marks)

(b) Draw the stereoisomers possible for CH_3-$(CHOH)_2$-COOH (4 Marks)

Course Outcome 5 (CO 5):

1. What is degree of hardness? (3 Marks)

2. Define BOD and COD (3 Marks)

3. (a) Explain the EDTA estimation of hardness (10 Marks)

(b) Standard hard water contains 20 g of CaCO3 per liter,50 mL of this required 30mL of EDTA solution, 50mL of sample water required 20mL of EDTA solution. 50mL sample water after boiling required 14 mL EDTA solution. Calculate the temporary hardness of the given sample of water, in terms of ppm. (4 Marks)

MODEL QUESTION PAPER

Total Pages:

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER B.TECH DEGREE EXAMINATION

Course Code: CYT100,

Course Name: ENGINEERING CHEMISTRY

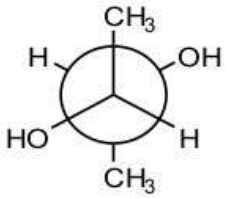
Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks Marks

1	What is potentiometric titration? How the end point is determined graphically?	(3)
2	What is Galvanic series? How is it different from electrochemical series?	(3)
3	Which of the following molecules can give IR absorption? Give reason? (a) O_2 (b) H_2O (c) N_2 (d) HCl	(3)
4	Which of the following molecules show UV-Visible absorption? Give reason. (a) Ethane (b) Butadiene (c) Benzene	(3)

5		What are the visualization techniques used in TLC?	(3)
6		Write the three important applications of nanomaterials.	(3)
7		Draw the Fischer projection formula and find R-S notation of	(3)



8		Write the structure of a) Polypyrroleb) Kevlar.	(3
9		What is break point chlorination?	(3)
10		What is reverse osmosis?	(3)

PART B

Answer any one full question from each module, each question carries 14 marks

Module 1

11	a)	Give the construction of Li-ion cell. Give the reactions that take place at the electrodes during charging and discharging. What happens to anodic material when the cell is 100% charged.	(10)
	b)	Calculate the standard electrode potential of Cu, if its electrode potential at 25 °C is 0.296 V and the concentration of Cu^{2+} is 0.015 M.	(4)

OR

12	a)	Explain the mechanism of electrochemical corrosion of iron in oxygen rich and oxygen deficient acidic and basic environments.	(10)
	b)	Given below are reduction potentials of some species	(4)

$MnO_4^- + 8H^+ + 5e \rightarrow Mn^{2+} + 4H_2O$; $E^0 = +1.51$ V

$Cl_2 + 2e \rightarrow 2Cl^-$; $E^0 = +1.36$ V

$S_2O_8^{2-} + 2e \rightarrow 2SO_4^{2-}$; $E^0 = +1.98$ V

Use the above data to examine whether the acids, dil. HCl and dil. H_2SO_4 , can be used to provide acid medium in redox titrations involving $KMnO_4$.

Module 2

13	a)	What is spin-spin splitting? Draw the NMR spectrum of (i) CH_3 CH_2CH_2 Br (ii) $CH_3CH(Br)CH_3$ Explain how NMR spectrum can be used to identify the two isomers.	(10)
	b)	A dye solution of concentration 0.08M shows absorbance of 0.012 at 600 nm; while a test solution of same dye shows absorbance of 0.084 under same conditions. Find the concentration of the test solution.	(4)

OR

14	a)	Explain the basic principle of UV-Visible spectroscopy. What are the possible electronic transitions? Explain with examples.	(10)
	b)	Sketch the vibrational modes of CO_2 and H_2O. Which of them are IR active?	(4)

Module 3

15	a)	Explain the principle, instrumentation and procedure involved in gas chromatography.	(10)
	b)	Explain the DTA of $CaC_2O_4.H_2O$ with a neat sketch.	(4)
		OR	
16	a)	Explain the various chemical methods used for the synthesis of nanomaterial	(10)
	b)	How TGA is used to analyse the thermal stability of polymers?	(4)

Module 4

17	a)	What are conformers? Draw the*cis* and *trans*isomers of 1, 3-dimethylcylohexane. Which conformer (chair form) is more stable in each case?	(10)
	b)	What is ABS? Give properties and applications.	(4)
		OR	
18	a)	Explain the various structural isomers with suitable example.	(10)
	b)	What is OLED? Draw a labelled diagram.	(4)

Module 5

19	a)	What are ion exchange resins? Explain ion exchange process for removal of hardness of water? How exhausted resins are regenerated?	(10)
	b)	50 mL sewage water is diluted to 2000 mL with dilution water; the initial dissolved oxygen was 7.7 ppm. The dissolved oxygen level after 5 days of incubation was 2.4 ppm. Find the BOD of the sewage.	(4)
		OR	
20	a)	What are the different steps in sewage treatment? Give the flow diagram. Explain the working of trickling filter.	(10)
	b)	Calculate the temporary and permanent hardness of a water sample which contains $[Ca^{2+}]$ = 160 mg/L, $[Mg^{2+}]$ = 192 mg/L and $[HCO_3^-]$ = 122 mg/L.	(4)

Syllabus

Module 1

Electrochemistry and Corrosion

Introduction - Differences between electrolytic and electrochemical cells - Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes - SHE - Calomel electrode - Glass Electrode - Construction and Working. Single electrode potential - definition - Helmholtz electrical double layer -Determination of E^0 using calomel electrode.Determination of pH using glass electrode.Electrochemical series and its applications. Free energy and EMF - Nernst Equation - Derivation - single electrode and cell (Numericals) -Application - Variation of emf with temperature. Potentiometric titration - Introduction -Redox titration only.Lithiumion cell - construction and working.Conductivity- Measurement of conductivity of a solution (Numericals).

Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.

Module 2

Spectroscopic Techniques and Applications

Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications. ^{1}H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).

Module 3

Instrumental Methods and Nanomaterials

Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$. Chromatographic methods - Basic principles and applications of column and TLC-Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.

Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).

Module 4

Stereochemistry and Polymer Chemistry

Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations). R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.

Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications.Kevlar-preparation, properties and applications.Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.

Module 5

Water Chemistry and Sewage Water Treatment

Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of

hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. Municipal water treatment (brief) - Disinfection methods - chlorination, ozone andUV irradiation.

Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals). Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.

Text Books

1. B. L. Tembe, Kamaluddin, M. S. Krishnan, "Engineering Chemistry (NPTEL Web-book)", 2018.

2. P. W. Atkins, "Physical Chemistry", Oxford University Press, 10th edn., 2014.

Reference Books

1. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw-Hill, 4thedn., 1995.
2. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
3. B. R. Puri, L. R. Sharma, M. S. Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 47th Edition, 2017.
4. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7th Edition, 2005.
5. Ernest L. Eliel, Samuel H. Wilen, "Stereo-chemistry of Organic Compounds", WILEY, 2008.
6. Raymond B. Seymour, Charles E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc; 4th Revised Edition, 1996.
7. MuhammedArif, Annette Fernandez, Kavitha P. Nair "Engineering Chemistry", Owl Books, 2019.
8. Ahad J., "Engineering Chemistry", Jai Publication, 2019.
9. Roy K. Varghese, "Engineering Chemistry", Crownplus Publishers, 2019.
10. Soney C. George,RinoLaly Jose, "Text Book of Engineering Chemistry", S. Chand & Company Pvt Ltd, 2019.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures (hrs)
1	**Electrochemistry and Corrosion**	**9**
1.1	Introduction - Differences between electrolytic and electrochemical cells- Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes- SHE - Calomel electrode - Glass Electrode - Construction and Working.	**2**
1.2	Single electrode potential – definition - Helmholtz electrical double layer - Determination of E^0 using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF - Nernst Equation – Derivation - single electrode and cell (Numericals) -Application -Variation of emf with temperature.	**3**
1.3	Potentiometric titration - Introduction -Redox titration only. Lithiumion cell - construction and working. Conductivity- Measurement of conductivity of a solution (Numericals).	**2**
1.4	Corrosion-Electrochemicalcorrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.	**2**
2	**Spectroscopic Techniques and Applications**	**9**
2.1	Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals).	**2**
2.2	UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.	**2**
2.3	IR-Spectroscopy – Principle - Number of vibrational modes -Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications.	**2**
2.4	^{1}H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).	**3**
3	**Instrumental Methods and Nanomaterials**	**9**
3.1	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$.	**2**

3.2	Chromatographic methods - Basic principles and applications of column and TLC-Retention factor.	**2**
3.3	GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications.	**2**
3.4	Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).	**3**
4	**Stereochemistry and Polymer Chemistry**	**9**
4.1	Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations).	**2**
4.2	R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples.	**1**
4.3	Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane.	**2**
4.4	Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.	**4**
5	**Water Chemistry and Sewage Water Treatment**	**9**
5.1	Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	**3**
5.2	Municipal water treatment (brief) - Disinfection methods - chlorination, ozone andUV irradiation.	**2**
5.3	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals).	**2**
5.4	Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process.	**2**

EST 100	ENGINEERING MECHANICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	1	0	3	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while stationary or in motion. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to:

CO 1	Recall principles and theorems related to rigid body mechanics
CO 2	Identify and describe the components of system of forces acting on the rigid body
CO 3	Apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	Choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	Solve problems involving rigid bodies, applying the properties of distributed areas and masses

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	15
Understand	10	10	15
Apply	30	30	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Part A

Course Outcome 1 (CO1): (One question from each module to meet the course objective 1: *To recall principles and theorems related to rigid body mechanics***)**

1. Explain D'Alembert's principle

2. Distinguish static and dynamic friction

3. State and explain perpendicular axis theorem

Course Outcome 2 (CO2) (One question from each module to meet the course objective 2: *To identify and describe the components of system of forces acting on the rigid body***)**

1. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.

2. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar

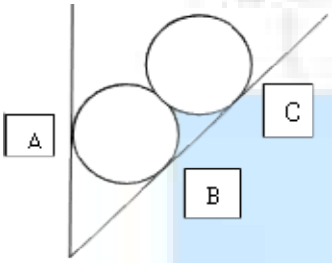
3. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

Part B

All the questions under this section shall assess the learning levels corresponding to the course outcomes listed below.

CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses

1. Two rollers each of weight 100 N are supported by an inclined plane and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth.

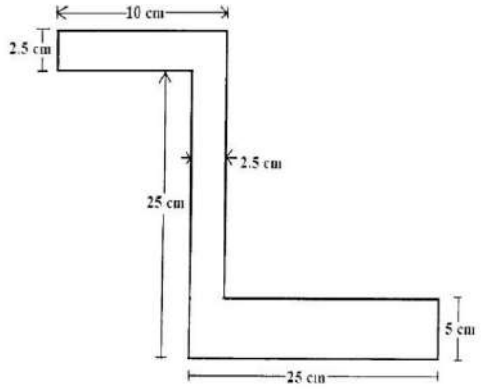


Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent equilibrium state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

2. A cylindrical disc, 50 cm diameter and cm thickness, is in contact with a horizontal conveyor belts running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s. Also compute the moment acting about the axis of the disc in both cases.

Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Sketch the free body diagram that represent state of the body)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

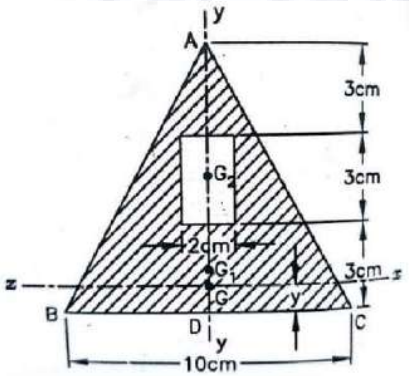
3. Determine the centroid of the given section



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of centroid for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed	Applying (Solve the problem based on the descriptions	6

	areas and masses	given in CO3 and CO4)	
Total			14

4. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC.



Course outcome identifier	Description of course outcome	Learning level assessed	Marks allocated
CO 3	To apply the conditions of equilibrium to various practical problems involving different force system.	Applying – (Illustrate the computation of moment of inertia for the given geometrical shape)	4
CO 4	To choose appropriate theorems, principles or formulae to solve problems of mechanics.	Applying (Choose the equations and formulae required for calculation)	4
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and masses	Applying (Solve the problem based on the descriptions given in CO3 and CO4)	6
Total			14

Model Question Paper

QP CODE:

Reg No.:_____

Name:_____ ___

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 100

ENGINEERING MECHANICS

Max. Marks: 100 Duration: 3 hours

Part A

(Answer all questions; each question carries 3 marks)

1. Explain D'Alembert's principle

2. Distinguish static and dynamic frictioni.

3. State and explain perpendicular axis theorem.

4. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.

5. A gymnast holding onto a bar, is suspended motionless in mid-air. The bar is supported by two ropes that attach to the ceiling. Diagram the forces acting on the combination of gymnast and bar

6. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path ?

7. Compare damped and undamped free vibrations.

8. State the equation of motion of a rotating rigid body, rotating about its fixed axis.

9. Illustrate the significance of instantaneous centre in the analysis of rigid body undergoing rotational motion.

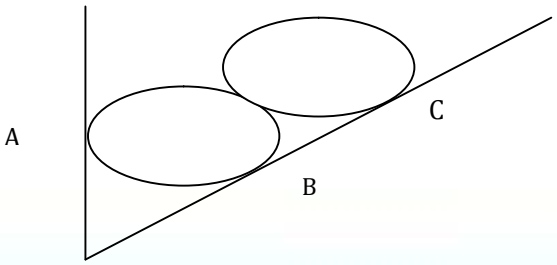
10. Highlight the principles of mechanics applied in the evaluation of elastic collusion of rigid bodies.

PART B

(Answer **one full** question from each module, each question carries **14** marks)

Module -I

11. Two identical rollers each of weight 100 N are supported by an inclined plane, making an angle of 30^{o} with the vertical, and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth. (14 marks)

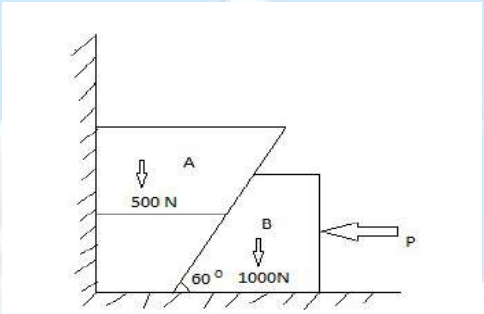


12. A string tied to a wall is made to pass over a pulley placed 2m away from it. A weight P is attached to the string such that the string stretches by 2m from the support on the wall to the location of attachment of weight. Determine the force P required to maintain 200 kg body in position for $\theta = 30^{o}$, The diameter of pulley B is negligible. (14 marks)

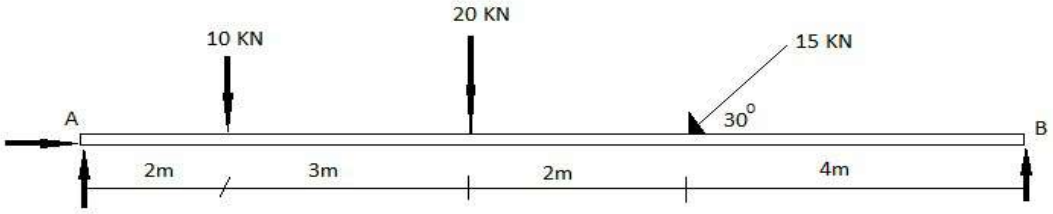
Module – 2

13. Two blocks A & B are resting against a wall and the floor as shown in figure below. Find the value of horizontal force P applied to the lower block that will hold the system in equilibrium. Coefficient of friction are : 0.25 at the floor, 0.3 at the wall and 0.2 between the blocks.

(14 marks)

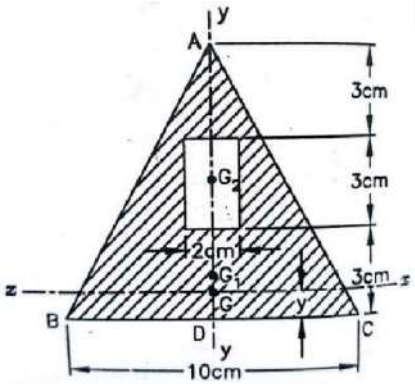


14. A beam is hinged at A and roller supported at B. It is acted upon by loads as shown below. Find the reactions at A & B. (14 marks)

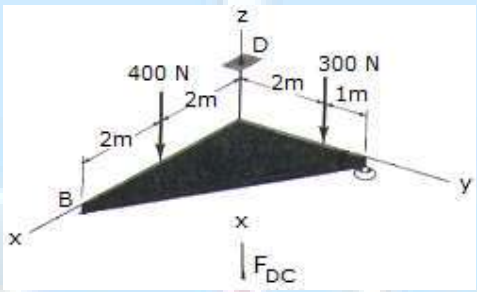


Module – 3

15. A rectangular hole is made in a triangular section as shown. Find moment of inertia about the section x-x passing through the CG of the section and parallel to BC. (14 marks)



16. Support A has ball and socket connection. Roller support at B prevents motion in the —z direction. Corner *C* is tied to *D* by a rope. The triangle is weightless. Determine the unknown force components acting at *A*, *B*, and *C*. (14 marks)



Module - 4

17. A cricket ball is thrown by a fielder from a height of 2m at an angle of 30^0 to the horizontal with an initial velocity of 20 m/s , hits the wickets at a height of 0.5 m from the ground. How far was the fielder from the wicket? (14 marks)

18. An engine of weight 500 kN pull a train weighing 1500 kN up an incline of 1 in 100. The train starts from rest and moves with constant acceleration against a resistance of 5 N/kN. It attains a maximum speed of 36 kmph in 1 km distance. Determine the tension in the coupling between train and engine and the traction force developed by the engine. (14marks)

Module – 5

19. A cylindrical disc, 50 cm diameter and 10 cm thickness having mass of 10 kg, is in contact with a horizontal conveyor belt running at uniform speeds of 5 m/s. Assuming there is no slip at points of contact determine (i) angular velocity of disc (ii) Angular acceleration of disc if velocity of conveyor changes to 8 m/s in 10 seconds. Also compute the moment acting about the axis of the disc in both cases. (14 marks)

20. A wheel rotating about fixed axis at 20 rpm is uniformly accelerated for 70 seconds during which time it makes 50 revolutions. Find the (i) angular velocity at the end of this interval and (ii) time required for the velocity to reach 100 revolutions per minute. (14 marks)

SYLLABUS

Module 1

Introduction to Engineering Mechanics-statics-basic principles of statics-Parallelogram law, equilibrium law, principles of superposition and transmissibility, law of action and reaction(review) free body diagrams.

Concurrent coplanar forces-composition and resolution of forces-resultant and equilibrium equations – methods of projections – methods of moments – Varignon's Theorem of moments.

Module 2

Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –wedges, ladder-analysis of connected bodies .

Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads. General coplanar force system - resultant and equilibrium equations.

Module 3

Centroid of composite areas- – moment of inertia-parallel axis and perpendicular axis theorems. Polar moment of inertia,radius of gyration,mass moment of inertia-ring,cylinder and disc.

Theorem of Pappus Guldinus(demonstration only)

Forces in space - vectorial representation of forces, moments and couples –resultant and equilibrium equations – concurrent forces in space (simple problems only)

Module 4

Dynamics – rectilinear translation - equations of kinematics(review)

kinetics – equation of motion – D'Alembert's principle. – motion on horizontal and inclined surfaces, motion of connected bodies. Impulse momentum equation and work energy equation (concepts only).

Curvilinear translation - equations of kinematics –projectile motion(review), kinetics – equation of motion. Moment of momentum and work energy equation (concepts only).

Module 5

Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – rotation under a constant moment.

Plane motion of rigid body – instantaneous centre of rotation (concept only).

Simple harmonic motion – free vibration –degree of freedom- undamped free vibration of spring mass system-effect of damping(concept only)

Text Books

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers
2. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
3. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson Education.

References

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.

2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications

3. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers

4. F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics, 9th Ed, Tata McGraw Hill

5. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd.

Course Contents and Lecture Schedule:

Module	Topic	Course outcomes addressed	No. of Hours
1	**Module 1**		**Total: 7**
1.1	Introduction to engineering mechanics – introduction on statics and dynamics - Basic principles of statics – Parellogram law, equilibrium law – Superposition and transmissibility, law of action and reaction (review the topics)	CO1 and CO2	1
1.2	Free body diagrams. Degree of freedom-types of supports and nature of reactions - exercises for free body diagram preparation – composition and resolution of forces, resultant and equilibrium equations (review the topics) - numerical exercises for illustration.	CO1 and CO2	1
1.3	Concurrent coplanar forces - analysis of concurrent forces -methods of projections – illustrative numerical exercise – teacher assisted problem solving.	CO1 and CO2	1
1.4	Analysis of concurrent forces -methods of moment-Varignon's Theorem of Moments - illustrative numerical exercise– teacher assisted problem solving.	CO1 and CO2	1
1.5	Analysis of concurrent force systems – extended problem solving - Session I.	CO3,CO4 and CO5	1
1.6	Analysis of concurrent force systems – extended problem solving - Session II – learning review quiz.	CO3,CO4 and CO5	1
1.7	Analysis of concurrent force systems – extended problem solving - Session III.	CO3,CO4 and CO5	1
2	**Module 2**		**Total: 7**
2.1	Friction – sliding friction - Coulomb's laws of friction – analysis of single bodies –illustrative examples on wedges and ladder-teacher	CO1 and CO2	1

	assisted problem solving tutorials using problems from wedges and ladder.		
2.2	Problems on friction - analysis of connected bodies. illustrative numerical exercise– teacher assisted problem solving.	CO3, CO4 and CO5	1
2.3	Problems on friction-extended problem solving	CO3,C04 and CO5	1
2.4	Parallel coplanar forces – couple - resultant of parallel forces – centre of parallel forces – equilibrium of parallel forces – Simple beam subject to concentrated vertical loads.	CO1 and CO2	1
2.5	General coplanar force system - resultant and equilibrium equations - illustrative examples- teacher assisted problem solving.	CO1 and CO2	1
2.6	General coplanar force system-resultant and equilibrium equations - illustrative examples	CO3, CO4 and CO5	1
2.7	General coplanar force system - Extended problem solving - Quiz to evaluate learning level.	CO3, CO4 and CO5	1
3	**Module 3**		**Total: 7**
3.1	Centroid of simple and regular geometrical shapes – centroid of figures in combination - composite areas- examples for illustration – problems for practice to be done by self.	CO1 and CO2	1
3.2	Moment of inertia- parallel axis theorem –examples for illustration - problems for practice to be done by self.	CO1 and CO2	1
3.3	Moment of inertia - perpendicular axis theorem - example for illustration to be given as hand out and discussion on the solved example.	CO1 and CO2	1
3.4	Solutions to practice problems – problems related to centroid and moment of inertia - problems for practice to be done by self.	CO3, CO4 and CO5	1
3.5	Polar moment of inertia, Radius of gyration. Mass moment of inertia of ring, cylinder and uniform disc. Theorem of Pappus Guldinus - Demonstration	CO1 and CO2	1
3.6	Introduction to forces in space – vectorial representation of forces, moments and couples – simple problems to illustrate vector representations of forces, moments and couples to be done in class.	CO1,and CO2	1
3.7	Solution to practice problems - resultant and equilibrium equations for concurrent forces in space – concurrent forces in space - 2 simple problems to illustrate the application of resultant and equilibrium equations for concurrent forces in space.	CO3,CO4 and CO5	1
4	**Module 4**		**Total: 7**

4.1	Introduction to dynamics – review of rectilinear translation - equations of kinematics – problems to review the concepts – additional problems involving extended application as exercises .	CO1 and CO2	1
4.2	Solutions to exercises with necessary explanation given as hand out – introduction to kinetics – equation of motion – D'Alembert's principle – illustration of the concepts using one numerical exercise from motion on horizontal and inclined surfaces.	CO1 and CO2	1
4.3	Motion of connected bodies - example for illustration to be given as hand out and discussion on the solved example – problems for practice to be done by self.	CO3, CO4 and CO5	1
4.4	Motion of connected bodies-extended problem solving.	CO3, CO4 & CO5	1
4.5	Curvilinear translation - Review of kinematics –projectile motion – simple problems to review the concepts – introduction to kinetics – equation of motion – illustration of the concepts using numerical exercises.	CO3, CO4 & CO5	1
4.6	Extended problem solving – rectilinear and curvilinear translation.	CO3, CO4 & CO5	1
4.7	Concepts on Impulse momentum equation and work energy equation (rectilinear translation – discussions to bring out difference between elastic and inelastic collusions). Concepts on Moment of momentum and work energy equation (curvilinear translation).	CO1 and CO2	1
5	**Module 5**		**Total: 7**
5.1	Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis – simple problems for illustration.	CO1 and CO2	1
5.2	Rotation under a constant moment – teacher assisted problem solving.	CO3,CO4 and CO5	1
5.3	Rotation under a constant moment - extended problem solving.	CO3, CO4 and CO5	1
5.4	Plane motion of rigid body- instantaneous centre of rotation (concept only).	CO1 and CO2	1
5.5	Introduction to harmonic oscillation –free vibrations - simple harmonic motion – differential equation and solution. Degree of freedom – examples of single degree of freedom (SDOF) systems – Idealisation of mechanical systems as spring-mass systems (concept only).	CO1 and CO2	1

5.6	SDOF spring mass system –equation of motion – undamped free vibration response - concept of natural frequency. Free vibration response due to initial conditions. Simple problems on determination of natural frequency and free vibration response to test the understanding level.	CO1 and CO2	1
5.7	Free vibration analysis of SDOF spring-mass systems – Problem solving Effect of damping on free vibration response (concept only).	CO1and CO2	1

EST 110	ENGINEERING GRAPHICS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		ESC	2	0	2	3	2019

Preamble: To enable the student to effectively perform technical communication through graphical representation as per global standards.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Draw the projection of points and lines located in different quadrants
CO 2	Prepare multiview orthographic projections of objects by visualizing them in different positions
CO 3	Draw sectional views and develop surfaces of a given object
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three dimensions.
CO 5	Convert 3D views to orthographic views
CO 6	Obtain multiview projections and solid models of objects using CAD tools

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3											
CO 3	3	1										
CO 4	3									1		
CO 5	3									2		
CO 6	3				3					3		

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (100 Marks)
	Test 1 (15 Marks)	Test 2 (15 Marks)	
Remember			
Understand	5		20
Apply	10	10	80
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE (Marks)	ESE (Marks)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

CIA for section A carries 25 marks (15 marks for 1 test and Class work 10 marks)

CIA for section B carries 15 marks (10 marks for 1 test and Class work 5 marks)

End Semester Examination Pattern:

ESE will be of 3 hour duration on A4 size answer booklet and will be for 100 marks. The question paper shall contain two questions from each module of Section A only. Student has to answer any one question from each module. Each question carries 20 marks.

Course Level Assessment Questions

(Questions may be framed based on the outline given under each course outcome)

Course Outcome 1 (CO1):

1. Locate points in different quadrants as per given conditions.
2. Problems on lines inclined to both planes .
3. Find True length, Inclinations and Traces of lines.

Course Outcome 2 (CO2)

1. Draw orthographic views of solids and combination solids
2. Draw views of solids inclined to any one reference plane.
3. Draw views of solids inclined to both reference planes.

Course Outcome 3 (CO3):

1. Draw views of solids sectioned by a cutting plane
2. Find location and inclination of cutting plane given true shape of the section
3. Draw development of lateral surface of solids and also its sectioned views

Course Outcome 4 (CO4):

1. Draw Isometric views/projections of soilds
2. Draw Isometric views/projections of combination of soilds
3. Draw Perspective views of Soilds

Course Outcome 5 (CO5):

1. Draw Orthographic views of solids from given three dimensional view

Course Outcome 6 (CO6):

1. Draw the given figure including dimensions using 2D software
2. Create 3D model using modelling software from the given orthographic views or 3D figure or from real 3D objects

Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 110

ENGINEERING GRAPHICS

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

Instructions: Retain necessary Construction lines
Show necessary dimensions
Answer any ONE question from each module
Each question carries 20 marks

MODULE I

1. The end point A of a line is 20mm above HP and 10mm in front of VP. The other end of the line is 50mm above HP and 15mm behind VP. The distance between the end projectors is 70mm. Draw the projections of the line. Find the true length and true inclinations of the line with the principal planes. Also locate the traces of the line.
2. One end of a line is 20mm from both the principal planes of projection. The other end of the line is 50mm above HP and 40mm in front of VP. The true length of the line is 70mm. Draw the projections of the line. Find its apparent inclinations, elevation length and plan length. Also locate its traces.

MODULE II

3. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined 30^{o} to VP. Draw the projections of the solid.

4. A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at 30° to HP and 45° to VP. Draw the projections of the solid.

MODULE III

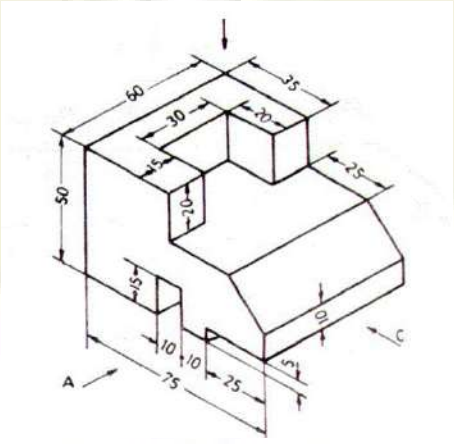
5. A triangular prism of base side 40mm and height 70mm is resting with its base on the ground and having an edge of the base perpendicular to VP. Section the solid such that the true shape of the section is a trapezium of parallel sides 30mm and 10mm. Draw the projections showing the true shape. Find the inclination of the cutting plane with the ground plane.
6. Draw the development of a pentagonal pyramid of base side 30mm and height 50mm. A string is wound from a corner of the base round the pyramid and back to the same point through the shortest distance. Show the position of the string in the elevation and plan.

MODULE IV

7. The frustum of a cone has base diameter 50mm and top diameter 40mm has a height of 60mm. It is paced centrally on top of a rectangular slab of size 80x60mm and of thickness 20mm. Draw the isometric view of the combination.
8. A hexagonal prism has base side 35mm and height 60mm. A sphere of diameter 40mm is placed centrally on top of it. Draw the isometric projection of the combination.

MODULE V

9. Draw the perspective view of a pentagonal prism, 20mm side and 45mm long lying on one of its rectangular faces on the ground and having its axis perpendicular to picture plane. One of its pentagonal faces touches the picture plane and the station point is 50mm in front of PP, 25mm above the ground plane and lies in a central plane, which is 70mm to the left of the center of the prism.
10. Draw three orthographic views with dimensions of the object shown in figure below.



(20X5=100)

Time : 3 hours **EST110 ENGINEERING GRAPHICS** **Max. Marks: 100**

SCHEME OF VALUATION

1. Locating the points and drawing the projections of the line – 4 marks
   Finding true length by any one method – 6 marks
   Finding true inclination with VP – 2 marks
   Finding true inclination with HP – 2 marks
   Locating horizontal trace – 2 marks
   Locating vertical trace – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

2. Locating the points and drawing true length of the line – 4 marks
   Finding projections by any method – 6 marks
   Finding length of elevation and plan – 2 marks
   Finding apparent inclinations – 2 marks
   Locating horizontal trace – 2 marks
   Locating vertical trace – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

3. Drawing initial position plan and elevation – 4 marks
   First inclination views – 4 marks
   Second inclination views -8 marks
   Marking invisible edges – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Any one method or combination of methods for solving can be used.
   If initial position is wrong then maximum 50% marks may be allotted for the answer)

4. Drawing initial position plan and elevation – 4 marks
   First inclination views – 4 marks
   Second inclination views -8 marks
   Marking invisible edges – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Any one method or combination of methods for solving can be used
   If initial position is wrong then maximum 50% marks may be allotted for the answer)

5. Drawing initial position plan and elevation – 4 marks
   Locating section plane as per given condition – 5 marks
   Drawing true shape -5 marks
   Finding inclination of cutting plane – 2 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

6. Drawing initial position plan and elevation – 4 marks
   Development of the pyramid – 6 marks

Locating string in development -2 marks
Locating string in elevation – 3 marks
Locating string in plan – 3 marks
Dimensioning and neatness – 2 marks

Total = 20 marks

7. Drawing initial positions – 4 marks
   Isometric View of Slab -6 marks
   Isometric View of Frustum – 10 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Initial position is optional, hence redistribute if needed.
   Reduce 4 marks if Isometric scale is taken)

8. Drawing initial positions – 4 marks
   Isometric scale – 4 marks
   Isometric projection of prism -5 marks
   Isometric projection of sphere – 5 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

   (Initial position is optional, hence redistribute if needed.

9. Drawing the planes and locating the station point – 4 marks
   Locating elevation points – 2 marks
   Locating plan points – 2 marks
   Drawing the perspective view – 10 marks
   Dimensioning and neatness – 2 marks

   Total = 20 marks

10. Drawing the elevation – 8marks
    Drawing the plan – 4 marks
    Drawing the side view – 4 marks
    Marking invisible edges – 2 marks
    Dimensioning and neatness – 2 marks

    Total = 20 marks

SYLLABUS

General Instructions:

- First angle projection to be followed
- Section A practice problems to be performed on A4 size sheets
- Section B classes to be conducted on CAD lab

SECTION A

Module 1

Introduction : Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.

Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes.

Module 2

Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.

Module 3

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given.

Development of Surfaces: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.

Module 4

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone , Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.

Module 5

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane.

Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.

SECTION B

(To be conducted in CAD Lab)

Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two dimensional drawing with dimensions using suitable software. (Minimum 2 exercises mandatory)

Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory)

Text Books

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.

Reference Books

1. Anilkumar, K.N., Engineering Graphics, Adhyuth narayan Publishers
2. Agrawal, B. And Agrawal, C.M., Engineering Darwing, Tata McGraw Hill Publishers.
3. Benjamin, J., Engineering Graphics, Pentex Publishers- 3rd Edition, 2017
4. Duff, J.M. and Ross, W.A., Engineering Design and Visualisation, Cengage Learning.
5. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K., Engineering Graphics with AutoCAD, PHI.
6. Luzaddff, W.J. and Duff, J.M., Fundamentals of Engineering Drawing, PHI.
7. Varghese, P.I., Engineering Graphics, V I P Publishers
8. Venugopal, K., Engineering Drawing and Graphics, New Age International Publishers.

Course Contents and Lecture Schedule

No	**SECTION A**	No. of Hours
1	**MODULE I**	
1.1	Introduction to graphics, types of lines, Dimensioning	1
1.2	Concept of principle planes of projection, different quadrants, locating points on different quadrants	2
1.3	Projection of lines, inclined to one plane. Lines inclined to both planes, trapezoid method of solving problems on lines.	2
1.4	Problems on lines using trapezoid method	2
1.5	Line rotation method of solving, problems on line rotation method	2
2	**MODULE II**	
2.1	Introduction of different solids, Simple position plan and elevation of solids	2
2.2	Problems on views of solids inclined to one plane	2
2.3	Problems on views of solids inclined to both planes	2
2.4	Practice problems on solids inclined to both planes	2

3	**MODULE III**	
3.1	Introduction to section planes. AIP and AVP. Principle of locating cutting points and finding true shape	2
3.2	Problems on sections of different solids	2
3.3	Problems when the true shape is given	2
3.4	Principle of development of solids, sectioned solids	2
4	**MODULE IV**	
4.1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2
4.2	Isometric problems on Frustum of solids, Sphere and Hemisphere	2
4.3	Problems on combination of different solids	2
5	**MODULE V**	
5.1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2
5.2	Perspective problems on prisms	2
5.3	Practice on conversion of pictorial views into orthographic views	2
	SECTION B *(To be conducted in CAD lab)*	
1	Introduction to CAD and software. Familiarising features of 2D software. Practice on making 2D drawings	2
2	Practice session on 2D drafting	2
3	Introduction to solid modelling and software	2
4	Practice session on 3D modelling	2

EST 120	BASICS OF CIVIL & MECHANICAL ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

To introduce the students to the basic principles of mechanical engineering

Prerequisite: NIL

Course Outcomes: After completion of the course, the student will be able to

CO 1	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
CO 2	Explain different types of buildings, building components, building materials and building construction
CO 3	Describe the importance, objectives and principles of surveying.
CO 4	Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps
CO 5	Discuss the Materials, energy systems, water management and environment for green buildings.
CO 6	Analyse thermodynamic cycles and calculate its efficiency
CO 7	Illustrate the working and features of IC Engines
CO 8	Explain the basic principles of Refrigeration and Air Conditioning
CO 9	Describe the working of hydraulic machines
CO 10	Explain the working of power transmission elements
CO 11	Describe the basic manufacturing, metal joining and machining processes

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	3	2	2	-	-	-	-
CO2	3	2	-	1	3	-	-	3	-	-	-	-
CO3	3	2	-	-	3	-	-	-	2	-	-	-

CO4	3	2	-	-	3	-	-	-	2	-	-	-
CO5	3	2	-	-	3	2	3	-	2	-	-	-
CO6	3	2										
CO7	3	1										
CO8	3	1										
CO9	3	2										
CO10	3	1										
CO11	3											

Assessment Pattern

Bloom's Category	**Basic Civil Engineering**			**Basic Mechanical Engineering**		
	Continuous Assessment		**End Semester Examination (marks)**	**Continuous Assessment**		**End Semester Examination (marks)**
	Test 1 marks	**Test 2 marks**		**Test 1 marks**	**Test 2 marks**	
Remember	5	5	10	7.5	7.5	15
Understand	20	20	40	12.5	12.5	25
Apply				5	5	10
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	**CIE (Marks)**	**ESE (Marks)**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern:

There will be two parts; Part I – Basic Civil Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts -

Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions:

Course Outcome CO1: *To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.*

1.Explain relevance of Civil engineering in the overall infrastructural development of the country.
Course outcome 2 (CO2) (One question from each module and not more than two)

Explain different types of buildings, building components, building materials and building construction

1. Discuss the difference between plinth area and carpet area.

Course outcome 3 (CO3) (One question from each module and not more than two)

Describe the importance, objectives and principles of surveying.

1. Explain the importance of surveying in Civil Engineering

Course outcome 4 (CO4) (One question from each module and not more than two)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps

1. Explain the civil engineering aspects of elevators, escalators and ramps in buildings

Course outcome 5 (CO5) (One question from each module and not more than two)

Discuss the Materials, energy systems, water management and environment for green buildings.

1. Discuss the relevance of Green building in society

Section II *Answer any 1 full question from each module. Each full question carries 10 marks*

Course Outcome 1 (CO1) (Two full question from each module and each question can have maximum 2 sub-divisions)

To recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering
CO Questions

1. a List out the types of building as per occupancy. Explain any two, each in about five sentences.
b. Discuss the components of a building with a neat figure.
2. a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework.

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country.

Course Outcome 2 (CO2) & Course Outcome 3 (CO3) (Two full question from each module and each question can have maximum 2 sub-divisions)

Explain different types of buildings, building components, building materials and building construction & Describe the importance, objectives and principles of surveying.

CO Questions

1. **a.** What are the different kinds of cement available and what is their use.
   b. List the properties of good building bricks. Explain any five.
2. a. List and explain any five modern construction materials used for construction.
   b. Explain the objectives and principles of surveying

Course outcome 4 (CO4) & Course outcome 5 (CO5) (Two full question from each module and each question can have maximum 2 sub-divisions)

Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps & Discuss the Materials, energy systems, water management and environment for green buildings.

CO Questions

1. **a**. Draw the elevation and plan of one brick thick wall with English bond
   b. Explain the energy systems and water management in Green buildings

2. **a.** Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing.

   b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building

Course Outcome 6 (CO6):

1. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35^{o}C, 0.1 MPa. The maximum temperature of the cycle is 1100^{o}C. Find
   i) Heat supplied per kg of air,
   ii) Work done per kg of air,
   iii) Cycle efficiency
   Take Cp = 1.005 kJ/kgK and Cv=0.718 kJ/kgK
2. A Carnot cycle works with adiabatic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of isothermal expansion is 0.3 m^{3}. If the maximum temperature and pressure is limited to 550K and 21 bar, determine the minimum temperature in the cycle and efficiency of the cycle.
3. In an ideal diesel cycle, the temperature at the beginning and end of compression is 65^{o}C and 620^{o}C respectively. The temperature at the beginning and end of the expansion is 1850^{o}C and 850 ^{o}C. Determine the ideal efficiency of the cycle.

4. Explain the concepts of CRDI and MPFI in IC Engines.

Course Outcome 7 (CO7)

1. With the help of a neat sketch explain the working of a 4 stroke SI engine
2. Compare the working of 2 stroke and 4 stroke IC engines
3. Explain the classification of IC Engines.

Course Outcome 8(CO8):

1. Explain the working of vapour compression refrigeration system.
2. With the help of suitable sketch explain the working of a split air conditioner.
3. Define: COP, specific humidity, relative humidity and dew point temperature.

Course Outcome 9 (CO9):

1. Explain the working of a single stage centrifugal pump with sketches.
2. With the help of a neat sketch, explain the working of a reciprocating pump.
3. A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s. If the overall efficiency of the turbine is 90%. Determine the power developed by the turbine.

Course Outcome 10 (CO10):

1. Explain the working of belt drive and gear drive with the help of neat sketches
2. Explain a single plate clutch.
3. Sketch different types of gear trains and explain.

Course Outcome 11 (CO11):

1. Describe the operations which can be performed using drilling machine.
2. Explain the functions of runners and risers used in casting.
3. With a neat sketch, explain the working and parts of a lathe.

Model Question Paper

QP CODE: **EST120** page:3

Reg No:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 120

Course Name: BASICS OF CIVIL AND MECHANICAL ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

PART I: BASIC CIVIL ENGINEERING

PART A

(Answer all questions. Each question carries 4 marks)

1. Explain relevance of Civil engineering in the overall infrastructural development of the country.
2. Discuss the difference between plinth area and carpet area.
3. Explain different types of steel with their properties.
4. What are the different kinds of cement available and what is their use?
5. Define bearing capacity of soil.

(5 x 4 = 20)

Part B

Answer one full question from each module.

MODULE I

6a. List out the types of building as per occupancy. Explain any two, each in about five sentences. (5)

b. Discuss the components of a building with a neat figure. (5)

OR

7a. What are the major disciplines of civil engineering and explain their role in the infrastructural framework. (5)

b. Explain the role of NBC, KBR & CRZ norms in building rules and regulations prevailing in our country. (5)

MODULE II

8a. What are the different kinds of cement available and what is their use. (5)

b. List the properties of good building bricks. Explain any five. (5)

OR

9a. List and explain any five modern construction materials used for construction. (5)

b. Explain the objectives and principles of surveying (5)

MODULE III

10a. Draw the elevation and plan of one brick thick wall with English bond (5)

b. Explain the energy systems and water management in Green buildings (5)

OR

11a. Draw neat sketch of the following foundations: (i) Isolated stepped footing; (ii) Cantilever footing; and (iii) Continuous footing. (5)

b. Discuss the civil engineering aspect of MEP and HVAC in a commercial building (5)

[10 x 3 = 30]

PART II: BASIC MECHANICAL ENGINEERING

PART A

Answer all questions. Each question carries 4 marks

1. Sketch the P-v and T-s diagram of a Carnot cycle and List the processes.
2. Illustrate the working of an epicyclic gear train.
3. Explain cooling and dehumidification processes.
4. Differentiate between soldering and brazing.
5. Explain the principle of Additive manufacturing.

4 x 5 = 20 marks

Part B

Answer one full question from each module.

MODULE I

6. In an air standard Otto cycle the compression ratio is 7 and compression begins at 35^{o}C, 0.1MPa. The maximum temperature of the cycle is 1100^{o}C. Find
   i) Heat supplied per kg of air,
   ii) Work done per kg of air,
   iii)Cycle efficiency

   Take C_p = 1.005 kJ/kgK and C_v=0.718 kJ/kgK — 10 marks

OR

7. a) Explain the working of a 4 stroke SI engine with neat sketches. — 7 marks
   b) Explain the fuel system of a petrol engine. — 3 marks

MODULE II

8. a) Explain the working of a vapour compression system with help of a block diagram. — 7 marks
   b) Define: Specific humidity, relative humidity and dew point temperature. — 3 marks

OR

9. With the help of a neat sketch, explain the working of a centrifugal pump. — 10 marks

MODULE III

10. Explain the two high, three high, four high and cluster rolling mills with neat sketches. — 10 marks

OR

11. a) Describe the arc welding process with a neat sketch. — 6 marks
    b) Differentiate between up-milling and down-milling operations. — 4 marks

SYLLABUS

Module 1

General Introduction to Civil Engineering: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.

Introduction to buildings: Types of buildings, selection of site for buildings, components of a residential building and their functions.

Building rules and regulations: Relevance of NBC, KBR & CRZ norms (brief discussion only).

Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

Module 2

Surveying: Importance, objectives and principles.

Construction materials, Conventional construction materials**:** types, properties and uses of building materials: bricks, stones, cement, sand and timber

Cement concrete: Constituent materials, properties and types.

Steel: Steel sections and steel reinforcements, types and uses.

Modern construction materials:- Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).

Module 3

Building Construction: Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Load bearing and framed structures (concept only).

Brick masonry: - Header and stretcher bond, English bond & Flemish bond random rubble masonry.

Roofs and floors: - Functions, types; flooring materials (brief discussion only).

Basic infrastructure services: MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings.

Green buildings:- Materials, energy systems, water management and environment for green buildings. (brief discussion only).

Module 4

Analysis of thermodynamic cycles: Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency. IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines(Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.

Module 5

Refrigeration: Unit of refrigeration, reversed Carnot cycle,COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.

Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)

Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

Module 6

Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.

Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications

Basic Machining operations: Turning, Drilling, Milling and Grinding.

Description about working with block diagram of: Lathe, Drilling machine, Milling machine, CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.

Text Books:

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. Mckay, W.B. and Mckay, J. K., Building Construction, Volumes 1 to 4, Pearson India Education Services

References Books:

1. Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
2. Chudley, R and Greeno R, Building construction handbook, Addison Wesley, Longman group, England
3. Chudley, R, Construction Technology, Vol. I to IV, Longman group, England Course Plan
4. Kandya A A, Elements of Civil Engineering, Charotar Publishing house
5. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
6. Rangwala S.C and Dalal K B Building Construction Charotar Publishing house
7. Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
8. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters &Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018
11. Benjamin,J.,Basic Mechanical Engineering,Pentex Books,9th Edition,2018
12. Balachandran, P.Basic Mechanical Engineering,Owl Books

Course Contents and Lecture Schedule:

No	Topic	Course outcomes addressed	No. of Lectures
1	**Module I**		**Total: 7**
1.1	*General Introduction to Civil Engineering*: Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment.	CO1	1
1.2	Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.	CO1	2
1.3	*Introduction to buildings:* Types of buildings, selection of site for buildings, components of a residential building and their functions.	CO2	2
1.4	*Building rules and regulations:* Relevance of NBC, KBR & CRZ norms (brief discussion only)	CO2	1
1.5	*Building area:* Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.	CO2	1
2	**Module 2**		**Total: 7**
2.1	*Surveying:* Importance, objectives and principles.	CO3	1
2.2	Bricks: - Classification, properties of good bricks, and tests on bricks	CO2	1
2.3	Stones: - *Qualities* of good stones, types of stones and their uses. Cement: - Good qualities of cement, types of cement and their uses.	CO2	1
2.4	Sand: - Classification, qualities of good sand and sieve analysis (basics only). Timber: - Characteristics, properties and uses.	CO2	1
2.5	Cement concrete: - Constituent materials, properties and types, Steel: - Steel sections and steel reinforcements, types and uses.	CO2	1

2.6	Modern construction materials: - Architectural glass, ceramics, plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials, modern uses of gypsum, pre-fabricated building components (brief discussion only)	CO2	2
3	**Module 3**		**Total: 7**
3.1	Foundations: - Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Brick masonry: - Header and stretcher bond, English bond & Flemish bond– elevation and plan (one & one and a half brick wall only). Random rubble masonry.	CO2	2
3.2	Roofs: Functions, types; roofing materials (brief discussion only) Floors: Functions, types; flooring materials (brief discussion only)	CO2	2
3.3	*Basic infrastructure services:* MEP, HVAC, Elevators, escalators and ramps (Civil Engineering aspects only) fire safety for buildings	CO4	2
3.4	*Green buildings:*- Materials, energy systems, water management and environment for green buildings. (brief discussion only)	CO5	1
4	**MODULE 4**		
4.1	Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle- Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency	4	
4.2	IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines, efficiencies of IC Engines(Description only)	2	
4.3	Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines	2	
5	**MODULE 5**		
5.1	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems)	1	
5.2	Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.	1	

5.3	Description about working with sketches : Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles)	4
5.4	Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches	3
6	**MODULE 6**	
6.1	Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.	2
6.2	Metal Joining Processes :List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications	1
6.3	Basic Machining operations: Turning, Drilling, Milling and Grinding Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine	3
6.4	Principle of CAD/CAM, Rapid and Additive manufacturing	1

EST 130	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	4	0	0	4	2019

Preamble:

This course aims to (1) equip the students with an understanding of the fundamental principles of electrical engineering(2) provide an overview of evolution of electronics, and introduce the working principle and examples of fundamental electronic devices and circuits (3) provide an overview of evolution of communication systems, and introduce the basic concepts in radio communication.

Prerequisite: Physics and Mathematics (Pre-university level)

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO 2	Develop and solve models of magnetic circuits
CO 3	Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state
CO 4	Describe working of a voltage amplifier
CO 5	Outline the principle of an electronic instrumentation system
CO 6	Explain the principle of radio and cellular communication

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	1	-	-	-	-	-	-	-	-	-	2
CO 3	3	1	-	-	-	-	-	-	-	-	-	2
CO 4	2	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	2
CO 6	2	-	-	-	-	-	-	-	-	-	-	2

Assessment Pattern

Bloom's Category	Basic Electrical Engineering			Basic Electronics Engineering		
	Continuous Assessment Tests		End Semester Examination (Marks)	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)		Test 1 (Marks)	Test 2 (Marks)	
Remember	0	0	10	10	10	20
Understand	12.5	12.5	20	15	15	30
Apply	12.5	12.5	20			
Analyse						
Evaluate						
Create						

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part I – Basic Electrical Engineering and Part II – Basic Electronics Engineering. Part I and PART II carries 50 marks each. For the end semester examination, part I contain 2 parts - Part A and Part B. Part A contain 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module out of which one to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **However, student should answer both part I and part 2 in separate answer booklets.**

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Solve problems based on current division rule.

2. Solve problems with Mesh/node analysis.

3. Solve problems on Wye-Delta Transformation.

Course Outcome 2 (CO2):

1. Problems on series magnetic circuits

2. Problems on parallel magnetic circuits

3. Problems on composite magnetic ciruits

4. **Course Outcome 3 (CO3):**

1. problems on self inductance, mutual inductance and coefficient of coupling

2. problems on rms and average values of periodic waveforms

3. problems on series ac circuits

4. Compare star and Delta connected 3 phase AC systems.

Course Outcome 4 (CO4): Describe working of a voltage amplifier

1.What is the need of voltage divider biasing in an RC coupled amplifier?

2. Define operating point in the context of a BJT amplifier.

3. Why is it required to have a voltage amplifier in a public address system?

Course Outcome 5 (CO5): Outline the principle of an electronic instrumentation system

1. Draw the block diagram of an electronic instrumentation system.

2. What is a transducer?

3. Explain the working principle of operation of digital multimeter.

Course Outcome 6 (CO6): Explain the principle of radio and cellular communication

1. What is the working principle of an antenna when used in a radio transmitter?

2. What is the need of two separate sections RF section and IF section in a super heterodyne receiver?

3. What is meant by a cell in a cellular communication?

Model Question Paper

QP CODE: Pages: 3

Reg No.:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: EST 130

Course Name: BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

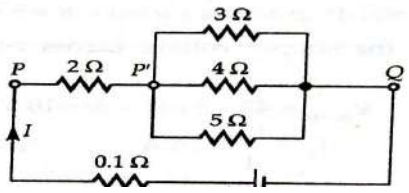
PART I

BASIC ELECTRICAL ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Calculate the current through the 4Ω resistor in the circuit shown, applying current division rule:



2. Calculate the RMS and average values of a purely sinusoidal current having peak value 15A.

3. An alternating voltage of (80+j60)V is applied to an RX circuit and the current flowing through the circuit is (-4+j10)A. Calculate the impedance of the circuit in rectangular and polar forms. Also determine if X is inductive or capacitive.

4. Derive the relation between line and phase values of voltage in a three phase star connected system.

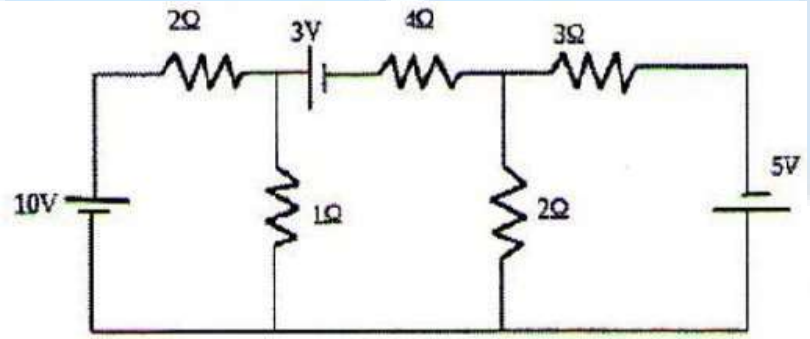
5. Compare electric and magnetic circuits. *(5x4=20)*

PART B

Answer one question from each module; each question carries 10 marks.

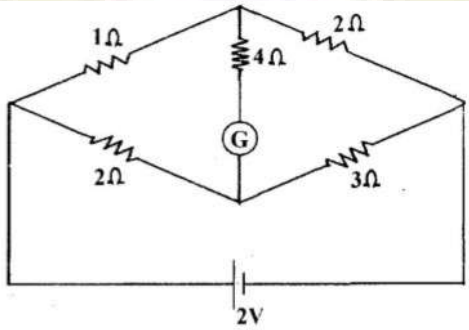
Module 1

6. . Calculate the node voltages in the circuit shown, applying node analysis:



7. (a) State and explain Kirchhoff's laws. (4 marks)

(b) Calculate the current through the galvanometer (G) in the circuit shown:



(6 marks)

Module 2

8. (a) State and explain Faraday's laws of electromagnetic induction with examples. (4 marks)

(b) Differentiate between statically and dynamically induced emf. A conductor of length 0.5m moves in a uniform magnetic field of flux density 1.1T at a velocity of 30m/s. Calculate the emf induced in the conductor if the direction of motion of the conductor is inclined at 60^0 to the direction of field. (6 marks)

9. (a) Derive the amplitude factor and form factor of a purely sinusoidal waveform. (5 marks)

(b) A current wave is made up of two components-a 5A dc component and a 50Hz ac component, which is a sinusoidal wave with a peak value of 5A. Sketch the resultant waveform and determine its RMS and average values. (5 marks)

Module 3

10. Draw the power triangle and define active, reactive and apparent powers in ac circuits. Two coils A and B are connected in series across a 240V, 50Hz supply. The resistance of A is 5Ω and the inductance of B is 0.015H. If the input from the supply is 3kW and 2kVAR, find the inductance of A and the resistance of B. Also calculate the voltage across each coil.

11. A balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the loads are connected in (i) star (ii) delta.

(3x10=30)

PART II

BASIC ELECTRONICS ENGINEERING

PART A

Answer all questions; each question carries 4 marks.

1. Give the specifications of a resistor. The colour bands marked on a resistor are Blue, Grey, Yellow and Gold. What are the minimum and maximum resistance values expected from that resistance?
2. What is meant by avalanche breakdown?
3. Explain the working of a full-wave bridge rectifier.
4. Discuss the role of coupling and bypass capacitors in a single stage RC coupled amplifier.
5. Differentiate AM and FM communication systems.

(5x4=20)

PART B

Answer one question from each module; each question carries 10 marks.

Module 4

6. a) Explain with diagram the principle of operation of an NPN transistor. (5)
   b) Sketch and explain the typical input-output characteristics of a BJT when connected in common emitter configuration. (5)

OR

7. a) Explain the formation of a potential barrier in a P-N junction diode. (5)
   b) What do you understand by Avalanche breakdown? Draw and explain the V-I characteristics of a P-N junction and Zener diode. (5)

Module 5

8. a) With a neat circuit diagram, explain the working of an RC coupled amplifier. (6)
   b) Draw the frequency response characteristics of an RC coupled amplifier and state the reasons for the reduction of gain at lower and higher frequencies. (4)

OR

9. a) With the help of block diagram, explain how an electronic instrumentation system. (6)
   b) Explain the principle of an antenna. (4)

Module 6

10. a) With the help of a block diagram, explain the working of Super hetrodyne receiver. (6)
    b) Explain the importance of antenna in a communication system. (4)

OR

11. a) With neat sketches explain a cellular communication system. (5)
    b) Explain GSM communication with the help of a block diagram. (5)

(3x10=30)

SYLLABUS

MODULE 1: Elementary Concepts of Electric Circuits

Elementary concepts of DC electric circuits: Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.

Analysis of DC electric circuits: Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.

MODULE 2: Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals

Magnetic Circuits: Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.

Electromagnetic Induction: Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling

Alternating Current fundamentals: Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.

MODULE 3: AC Circuits

AC Circuits: Phasor representation of sinusoidal quantities. Trignometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.

Three phase AC systems: Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems

MODULE 4

Introduction to Semiconductor devices: Evolution of electronics – Vacuum tubes to nano electronics. Resistors, Capacitors and Inductors (constructional features not required): types, specifications. Standard values, color coding. PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration.

MODULE 5

Basic electronic circuits and instrumentation: Rectifiers and power supplies: Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

MODULE 6

Introduction to Communication Systems: Evolution of communication systems – Telegraphy to 5G. Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge. Mobile communication: basic principles of cellular communications, principle and block diagram of GSM.

Text Books

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. ChinmoySaha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.
4. M.S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
5. Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010.

Reference Books

1. Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
3. Hayt W H, Kemmerly J E, and Durbin S M, "Engineering Circuit Analysis", Tata McGraw-Hill
4. Hughes, "Electrical and Electronic Technology", Pearson Education.
5. V. N. Mittle and Arvind Mittal, "Basic Electrical Engineering," Second Edition, McGraw Hill.
6. Parker and Smith, "Problems in Electrical Engineering", CBS Publishers and Distributors.
7. S. B. Lal Seksena and Kaustuv Dasgupta, "Fundamentals of Electrical Engineering", Cambridge University Press.
8. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
9. Bernard Grob, Ba sic Electronics, McGraw Hill.
10. A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lectures
1	***Elementary Concepts of Electric Circuits***	
1.1	**Elementary concepts of DC electric circuits:** Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems.	1 2 1
1.2	**Analysis of DC electric circuits:** Mesh current method - Matrix representation - Solution of network equations. Node voltage methods-matrix representation-solution of network equations by matrix methods. Numerical problems.	1 1 2
2	**Elementary Concepts of Magnetic circuits, Electromagnetic Induction and AC fundamentals**	
2.1	**Magnetic Circuits:** Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits- Series and parallel magnetic circuits with composite materials, numerical problems.	1 2
2.2	**Electromagnetic Induction:** Faraday's laws, problems, Lenz's law-statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling	1 2
2.3	**Alternating Current fundamentals:** Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems.	2
3	**AC Circuits**	

3.1	**AC Circuits:** Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power, Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.	1 2 1 2
3.2	**Three phase AC systems:** Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems.	2
4	**Introduction to Semiconductor devices**	
4.1	Evolution of electronics – Vacuum tubes to nano electronics (In evolutional perspective only)	1
4.2	Resistors, Capacitors and Inductors: types, specifications. Standard values, color coding (No constructional features)	2
4.3	**PN Junction diode**: Principle of operation, V-I characteristics, principle of avalanche breakdown	2
4.4	**Bipolar Junction Transistors:** PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration	3
5	**Basic electronic circuits and instrumentation**	
5.1	**Rectifiers and power supplies:** Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator	3
5.2	**Amplifiers:** Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing	4
5.3	**Electronic Instrumentation:** Block diagram of an electronic instrumentation system	2
6	**Introduction to Communication Systems**	
6.1	Evolution of communication systems – Telegraphy to 5G	1

6.2	**Radio communication:** principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge	4
6.3	**Mobile communication:** basic principles of cellular communications, principle and block diagram of GSM.	2

Suggested Simulation Assignments for Basic Electronics Engineering

1. Plot V-I characteristics of Si and Ge diodes on a simulator
2. Plot Input and Output characteristics of BJT on a simulator
3. Implementation of half wave and full wave rectifiers
4. Simulation of RC coupled amplifier with the design supplied
5. Generation of AM signal

Note: The simulations can be done on open tools such as QUCS, KiCad, GNURadio or similar software to augment the understanding.

HUN 102	PROFESSIONAL COMMUNICATION	CATEGORY	L	T	P	CREDIT
		MNC	2	0	2	--

Preamble: Clear, precise, and effective communication has become a *sine qua non* in today's information-driven world given its interdependencies and seamless connectivity. Any aspiring professional cannot but master the key elements of such communication. The objective of this course is to equip students with the necessary skills to listen, read, write, and speak so as to comprehend and successfully convey any idea, technical or otherwise, as well as give them the necessary polish to become persuasive communicators.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to

CO 1	Develop vocabulary and language skills relevant to engineering as a profession
CO 2	Analyze, interpret and effectively summarize a variety of textual content
CO 3	Create effective technical presentations
CO 4	Discuss a given technical/non-technical topic in a group setting and arrive at generalizations/consensus
CO 5	Identify drawbacks in listening patterns and apply listening techniques for specific needs
CO 6	Create professional and technical documents that are clear and adhering to all the necessary conventions

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1										3		2
CO 2										1		3
CO 3						1			1	3		
CO 4										3		1
CO 5		1							2	3		
CO 6	1					1			1	3		

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

Continuous Internal Evaluation

Total Marks: 50

Attendance	: 10 marks
Regular assessment	: 25 marks
Series test (one test only, should include verbal aptitude for placement and higher studies, this test will be conducted for 50 marks and reduced to 15)	: 15 marks

Regular assessment

Project report presentation and Technical presentation through PPT	: 7.5 marks
Listening Test	: 5 marks
Group discussion/mock job interview	: 7.5 marks
Resume submission	: 5 marks

End Semester Examination

Total Marks: 50, Time: 2 hrs.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List down the ways in which gestures affect verbal communication.
2. Match the words and meanings

Ambiguous	promotion
Bona fide	referring to whole
Holistic	not clear
Exaltation	genuine

3. Expand the following Compound Nouns - a. Water supply. b. Object recognition. c. Steam turbine

Course Outcome 2 (CO2)

1. Read the passage below and prepare notes:

Mathematics, rightly viewed, possesses not only truth, but supreme beauty—a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show. The true spirit of delight, the exaltation, the sense of being more than man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry. What is best in mathematics deserves not merely to be learnt as a task, but to be assimilated as a part of daily thought, and brought again and again before the mind with ever-renewed encouragement. Real life is, to most men, a long second-best, a perpetual compromise between the ideal and the possible; but the world of pure reason knows no compromise, no practical limitations, no barrier to the creative activity embodying in splendid edifices the passionate aspiration after the perfect from which all great work springs. Remote from human passions, remote even from the pitiful facts of nature, the generations have gradually created an ordered cosmos, where pure thought can dwell as in its natural home, and where one, at least, of our nobler impulses can escape from the dreary exile of the actual world.

So little, however, have mathematicians aimed at beauty, that hardly anything in their work has had this conscious purpose. Much, owing to irrepressible instincts, which were better than avowed

beliefs, has been moulded by an unconscious taste; but much also has been spoilt by false notions of what was fitting. The characteristic excellence of mathematics is only to be found where the reasoning is rigidly logical: the rules of logic are to mathematics what those of structure are to architecture. In the most beautiful work, a chain of argument is presented in which every link is important on its own account, in which there is an air of ease and lucidity throughout, and the premises achieve more than would have been thought possible, by means which appear natural and inevitable. Literature embodies what is general in particular circumstances whose universal significance shines through their individual dress; but mathematics endeavours to present whatever is most general in its purity, without any irrelevant trappings.

How should the teaching of mathematics be conducted so as to communicate to the learner as much as possible of this high ideal? Here experience must, in a great measure, be our guide; but some maxims may result from our consideration of the ultimate purpose to be achieved.

- From "On the teaching of mathematics" – Bertrand Russell

2. Enumerate the advantages and disadvantages of speed reading. Discuss how it can impact comprehension.

Course Outcome 3(CO3):

1. What are the key elements of a successful presentation?
2. Elucidate the importance of non-verbal communication in making a presentation
3. List out the key components in a technical presentation.

Course Outcome 4 (CO4):

1. Discuss: 'In today's world, being a good listener is more important than being a good Speaker.'
2. Listen to a video/live group discussion on a particular topic, and prepare a brief summary of the proceedings.
3. List the do's and don'ts in a group discussion.

Course Outcome 5 (CO5):

1. Watch a movie clip and write the subtitles for the dialogue.
2. What do you mean by barriers to effective listening? List ways to overcome each of these.
3. What are the different types of interviews? How are listening skills particularly important in Skype/telephonic interviews?

Course Outcome 6 (CO6):

1. Explain the basic structure of a technical report.
2. You have been offered an internship in a much sought-after aerospace company and are very excited about it. However, the dates clash with your series tests. Write a letter to the Manager – University Relations of the company asking them if they can change the dates to coincide with your vacation.
3. You work in a well-reputed aerospace company as Manager – University Relations. You are in charge of offering internships. A student has sent you a letter requesting you to change the dates allotted to him since he has series exams at that time. But there are no vacancies available during the period he has requested for. Compose an e-mail informing him of this and suggest that he try to arrange the matter with his college.

Syllabus

Module 1

Use of language in communication: Significance of technical communication Vocabulary Development: technical vocabulary, vocabulary used in formal letters/emails and reports, sequence words, misspelled words, compound words, finding suitable synonyms, paraphrasing, verbal analogies. Language Development: subject-verb agreement, personal passive voice, numerical adjectives, embedded sentences, clauses, conditionals, reported speech, active/passive voice.

Technology-based communication: Effective email messages, slide presentations, editing skills using software. Modern day research and study skills: search engines, repositories, forums such as Git Hub, Stack Exchange, OSS communities (MOOC, SWAYAM, NPTEL), and Quora; Plagiarism

Module 2

Reading, Comprehension, and Summarizing: Reading styles, speed, valuation, critical reading, reading and comprehending shorter and longer technical articles from journals, newspapers, identifying the various transitions in a text, SQ3R method, PQRST method, speed reading. Comprehension: techniques, understanding textbooks, marking and underlining, Note-taking: recognizing non-verbal cues.

Module 3

Oral Presentation: Voice modulation, tone, describing a process, Presentation Skills: Oral presentation and public speaking skills, business presentations, Preparation: organizing the material, self-Introduction, introducing the topic, answering questions, individual presentation practice, presenting visuals effectively.

Debate and Group Discussions: introduction to Group Discussion (GD), differences between GD and debate; participating GD, understanding GD, brainstorming the topic, questioning and clarifying, GD strategies, activities to improve GD skills

Module 4

Listening and Interview Skills Listening: Active and Passive listening, listening: for general content, to fill up information, intensive listening, for specific information, to answer, and to understand. Developing effective listening skills, barriers to effective listening, listening to longer technical talks, listening to classroom lectures, talks on engineering /technology, listening to documentaries and making notes, TED talks.

Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (skype) interviews, one-to-one interview & panel interview, FAQs related to job interviews

Module 5

Formal writing: Technical Writing: differences between technical and literary style. Letter Writing (formal, informal and semi formal), Job applications, Minute preparation, CV preparation (differences between Bio-Data, CV and Resume), and Reports. Elements of style, Common Errors in Writing: describing a process, use of sequence words, Statements of Purpose, Instructions, Checklists.

Analytical and issue-based Essays and Report Writing: basics of report writing; Referencing Style (IEEE Format), structure of a report; types of reports, references, bibliography.

Lab Activities

Written: Letter writing, CV writing, Attending a meeting and Minute Preparation, Vocabulary Building

Spoken: Phonetics, MMFS (Multimedia Feedback System), Mirroring, Elevator Pitch, telephone etiquette, qualities of a good presentation with emphasis on body language and use of visual aids.

Listening: Exercises based on audio materials like radio and podcasts. Listening to Song. practice and exercises.

Reading: Speed Reading, Reading with the help of Audio Visual Aids, Reading Comprehension Skills

Mock interview and Debate/Group Discussion: concepts, types, Do's and don'ts- intensive practice

Reference Books

1. English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Blackswan 2010.
2. Meenakshi Raman and Sangeetha Sharma,"Technical Communication: Principles and Practice", 2nd Edition, Oxford University Press, 2011
3. Stephen E. Lucas, "The Art of Public Speaking", 10th Edition; McGraw Hill Education, 2012.
4. Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw Hill Education, 2017.
5. William Strunk Jr. & E.B. White, "The Elements of Style", 4th Edition, Pearson, 1999.
6. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
7. Goodheart-Willcox, "Professional Communication", First Edition , 2017.
8. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6 edition, 2015.
9. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.
10. Anand Ganguly, "Success in Interview", RPH, 5th Edition, 2016.
11. Raman Sharma, "Technical Communications", Oxford Publication, London, 2004.

EST 102	PROGRAMING IN C	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	2	1	2	4	2019

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of writing readable C programs to solve computational problems that they may have to solve in their professional life. The course content is decided to cover the essential programming fundamentals which can be taught within the given slots in the curriculum. This course has got 2 Hours per week for practicing programming in C. A list showing 24 mandatory programming problems are given at the end. The instructor is supposed to give homework/assignments to write the listed programs in the rough record as and when the required theory part is covered in the class. The students are expected to come prepared with the required program written in the rough record for the lab classes.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Analyze a computational problem and develop an algorithm/flowchart to find its solution
CO 2	Develop readable* C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or Bitwise operators.
CO 3	Write readable C programs with arrays, structure or union for storing the data to be processed
CO 4	Divide a given computational problem into a number of modules and develop a readable multi-function C program by using recursion if required, to find the solution to the computational problem
CO 5	Write readable C programs which use pointers for array processing and parameter passing
CO 6	Develop readable C programs with files for reading input and storing output

readable* - readability of a program means the following:

1. Logic used is easy to follow
2. Standards to be followed for indentation and formatting
3. Meaningful names are given to variables
4. Concise comments are provided wherever needed

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓		✓				✓	✓	✓
CO2	✓	✓	✓	✓	✓					✓		✓
CO3	✓	✓	✓	✓	✓					✓		✓
CO4	✓	✓	✓	✓	✓					✓	✓	✓
CO5	✓	✓			✓					✓		✓
CO6	✓	✓			✓					✓		✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	10	25
Understand	10	15	25
Apply	20	20	40
Analyse	5	5	10
Evaluate			
Create			

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test 1 (for theory, for 2 hrs)	: 20 marks
Continuous Assessment Test 2 (for lab, internal examination, for 2 hrs)	: 20 marks

Internal Examination Pattern: There will be two parts; Part A and Part B. Part A contains 5 questions with 2 questions from each module (2.5 modules x 2 = 5), having 3 marks for each question. Students should answer all questions. Part B also contains 5 questions with 2 questions from each module (2.5 modules x 2 = 5), of which a student should answer any one. The questions should not have sub-divisions and each one carries 7 marks.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1): Write an algorithm to check whether largest of 3 natural numbers is prime or not. Also, draw a flowchart for solving the same problem.

Course Outcome 2 (CO2): Write an easy to read C program to process a set of n natural numbers and to find the largest even number and smallest odd number from the given set of numbers. The program should not use division and modulus operators.

Course Outcome 3(CO3): Write an easy to read C program to process the marks obtained by n students of a class and prepare their rank list based on the sum of the marks obtained. There are 3 subjects for which examinations are conducted and the third subject is an elective where a student is allowed to take any one of the two courses offered.

Course Outcome 4 (CO4): Write an easy to read C program to find the value of a mathematical function f which is defined as follows. f(n) = n! / (sum of factors of n), if n is not prime and f(n) = n! / (sum of digits of n), if n is prime.

Course Outcome 5 (CO5): Write an easy to read C program to sort a set of n integers and to find the number of unique numbers and the number of repeated numbers in the given set of numbers. Use a function which takes an integer array of n elements, sorts the array using the Bubble Sorting Technique and returns the number of unique numbers and the number of repeated numbers in the given array.

Course Outcome 6 (CO6): Write an easy to read C program to process a text file and to print the Palindrome words into an output file.

Model Question paper

QP CODE: PAGES:3

Reg No:_____

Name :_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: **EST 102**

Course Name: Programming in C (Common to all programs)

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Write short note on processor and memory in a computer.
2. What are the differences between compiled and interpreted languages? Give example for each.
3. Write a C program to read a Natural Number through keyboard and to display the reverse of the given number. For example, if "3214567" is given as input, the output to be shown is "7654123".
4. Is it advisable to use *goto* statements in a C program? Justify your answer.
5. Explain the different ways in which you can *declare & initialize* a single dimensional array.
6. Write a C program to read a sentence through keyboard and to display the count of white spaces in the given sentence.
7. What are the advantages of using functions in a program?
8. With a simple example program, explain *scope* and *life time* of variables in C.
9. Write a function in C which takes the address of a single dimensional array (containing a finite sequence of numbers) and the number of numbers stored in the array as arguments and stores the numbers in the same array in reverse order. Use pointers to access the elements of the array.
10. With an example, explain the different modes of opening a file. (10x3=30)

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. (a) Draw a flow chart to find the position of an element in a given sequence, using linear searching technique. With an example explain how the flowchart finds the position of a given element. **(10)**

    (b) Write a pseudo code representing the flowchart for linear searching. **(4)**

OR

12. (a) With the help of a flow chart, explain the bubble sort operation. Illustrate with an example. **(10)**
    (b) Write an algorithm representing the flowchart for bubble sort. **(4)**

13. (a) Write a C program to read an English Alphabet through keyboard and display whether the given Alphabet is in upper case or lower case. **(6)**
    (b) Explain how one can use the builtin function in C, *scanf*to read values of different data types. Also explain using examples how one can use the builtin function in C, *printf*for text formatting. **(8)**

OR

14. (a) With suitable examples, explain various operators in C. (10)
    (b) Explain how characters are stored and processed in C. **(4)**

15. (a) Write a function in C which takes a 2-Dimensional array storing a matrix of numbers and the order of the matrix (number of rows and columns) as arguments and displays the sum of the elements stored in each row. **(6)**
    (b) Write a C program to check whether a given matrix is a diagonal matrix. **(8)**

OR

16. (a) Without using any builtin string processing function like *strlen*, *strcat* etc., write a program to concatenate two strings. **(8)**
    (b) Write a C program to perform bubble sort. **(6)**

17. (a) Write a function namely *myFact* in C to find the factorial of a given number. Also, write another function in C namely*nCr* which accepts two positive integer parameters *n* and *r* and returns the value of the mathematical function*C(n,r)*(n! / (r! x (n - r)!)). The function *nCr* is expected to make use of the factorial function *myFact.* *(10)*
    (b) What is recursion? Give an example. **(4)**

OR

18. (a) With a suitable example, explain the differences between a structure and a union in C. **(6)**
    (b) Declare a structure namely *Student* to store the details (*roll number, name, mark_for_C*) of a student. Then, write a program in C to find the average mark obtained by the students in a class for the subject *Programming in C* (using the field *mark_for_C*). Use array of structures to store the required data **(8)**

19. (a) With a suitable example, explain the concept of pass by reference. **(6)**
    (b) With a suitable example, explain how pointers can help in changing the content of a single dimensionally array passed as an argument to a function in C. **(8)**

OR

20. (a) Differentiate between sequential files and random access files? **(4)**

(b) Using the prototypes explain the functionality provided by the following functions. (10)

rewind()

i. *fseek()*

ii. *ftell()*

iii. *fread()*

iv. *fwrite()* ***(14X5=70)***

SYLLABUS

Programming in C (Common to all disciplines)

Module 1

Basics of Computer Hardware and Software

Basics of Computer Architecture: processor, Memory, Input& Output devices

Application Software & System software: Compilers, interpreters, High level and low level languages Introduction to structured approach to programming, Flow chart Algorithms, Pseudo code (*bubble sort, linear search - algorithms and pseudocode*)

Module 2

Program Basics

Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types , Constants, Console IO Operations, printf and scanf

Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence

Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements.(Simple programs covering control flow)

Module 3

Arrays and strings

Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array

String processing: In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets) Linear search program, bubble sort program, simple programs covering arrays and strings

Module 4

Working with functions

Introduction to modular programming, writing functions, formal parameters, actual parameters Pass by Value, Recursion, Arrays as Function Parameters structure, union, Storage Classes, Scope and life time of variables, *simple programs using functions*

Module 5

Pointers and Files

Basics of Pointer: declaring pointers, accessing data though pointers, NULL pointer,array access using pointers, pass by reference effect

File Operations: open, close, read, write, append

Sequential access and random access to files: In built file handlingfunctions (*rewind() ,fseek(), ftell(), feof(), fread(), fwrite()*), *simple programs covering pointers and files.*

Text Books

1. Schaum Series, Gottfried B.S.,Tata McGraw Hill,Programming with C
2. E. Balagurusamy, Mcgraw Hill,Programming in ANSI C
3. Asok N Kamthane, Pearson,Programming in C
4. Anita Goel, Pearson, Computer Fundamentals

Reference Books

1. Anita Goel and Ajay Mittal, Pearson, Computer fundamentals and Programming in C
2. Brian W. Kernighan and Dennis M. Ritchie, Pearson, C Programming Language
3. Rajaraman V, PHI, Computer Basics and Programming in C
4. Yashavant P, Kanetkar, BPB Publications, Let us C

Course Contents and Lecture Schedule

Module 1: Basics of Computer Hardware and Software		**(7 hours)**
1.1	**Basics of Computer Architecture:** Processor, Memory, Input& Output devices	**2 hours**
1.2	**Application Software & System software:** Compilers, interpreters, High level and low level languages	**2 hours**
1.3	Introduction to structured approach to programming, Flow chart	**1 hours**
1.4	Algorithms, Pseudo code (*bubble sort, linear search - algorithms and pseudocode*)	**2 hours**
Module 2: Program Basics		**(8 hours)**
2.1	**Basic structure of C program:** Character set, Tokens, Identifiers in C, Variables and Data Types , Constants, Console IO Operations, printf and scanf	**2 hours**
2.2	**Operators and Expressions:** Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, sizeof operator, Assignment operators and Bitwise Operators. Operators Precedence	**2 hours**

2.3	**Control Flow Statements:** If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements.*(Simple programs covering control flow)*	**4 hours**
Module 3: Arrays and strings:		**(6 hours)**
3.1	Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array	**2 hours**
3.2	**String processing:** In built String handling functions(*strlen, strcpy, strcat and strcmp, puts, gets*)	**2 hours**
3.3	Linear search program, bubble sort program, *simple programs covering arrays and strings*	**3 hours**
Module 4: Working with functions		**(7 hours)**
4.1	Introduction to modular programming, writing functions, formal parameters, actual parameters	**2 hours**
4.2	Pass by Value, Recursion, Arrays as Function Parameters	**2 hours**
4.3	structure, union, Storage Classes,Scope and life time of variables, *simple programs using functions*	**3 hours**
Module 5: Pointers and Files		**(7 hours)**
5.1	**Basics of Pointer**: declaring pointers, accessing data though pointers, NULL pointer,array access using pointers, pass by reference effect	**3 hours**
5.2	**File Operations**: open, close, read, write, append	1 **hours**
5.3	**Sequential access and random access to files:** In built file handlingfunctions (*rewind() ,fseek(), ftell(), feof(), fread(), fwrite()*)**,** *simple programs covering pointers and files.*	**2 hours**

C PROGRAMMING LAB (Practical part of EST 102, Programming in C)

Assessment Method: The Academic Assessment for the Programming lab should be done internally by the College. The assessment shall be made on 50 marks and the mark is divided as follows: Practical Records/Outputs - 20 marks (internal by the College), Regular Lab Viva - 5 marks (internal by the College), Final Practical Exam – 25 marks (internal by the College).

The mark obtained out of 50 will be converted into equivalent proportion out of 20 for CIE computation.

LIST OF LAB EXPERIMENTS

1. Familiarization of Hardware Components of a Computer

2. Familiarization of Linux environment – How to do Programming in C with Linux

3. Familiarization of console I/O and operators in C

i) Display "Hello World"

ii) Read two numbers, add them and display theirsum

iii) Read the radius of a circle, calculate its area and display it

iv)Evaluate the arithmetic expression ((a -b / c * d + e) * (f +g)) and display its solution.Read the values of the variables from the user through console.

4. Read 3 integer values and find the largest amoung them.

5. Read a Natural Number and check whether the number is prime or not

6. Read a Natural Number and check whether the number is Armstrong or not

7. Read n integers, store them in an array and find their sum and average

8. Read n integers, store them in an array and search for an element in the array using an algorithm for Linear Search

9. Read n integers, store them in an array and sort the elements in the array using Bubble Sort algorithm

10**.** Read a string (word), store it in an array and check whether it is a palindrome word or not.

11. Read two strings (each one ending with a $ symbol), store them in arrays and concatenate them without using library functions.

12. Read a string (ending with a $ symbol), store it in an array and count the number of vowels, consonants and spaces in it.

13. Read two input each representing the distances between two points in the Euclidean space, store these in structure variables and add the two distance values.

14. Using structure, read and print data of n employees (*Name, Employee Id and Salary*)

15. Declare a union containing 5 string variables (*Name, House Name, City Name, State and Pin code*) each with a length of C_SIZE (user defined constant). Then, read and display the address of a person using a variable of the union.

16. Find the factorial of a given Natural Number n usingrecursive and non recursive functions

17. Read a string (word), store it in an array and obtain its reverse by using a user defined function.

18. Write a menu driven program for performing matrix addition, multiplication and finding the transpose. Use functions to (i) read a matrix, (ii) find the sum of two matrices, (iii) find the product of two matrices, (i) find the transpose of a matrix and (v) display a matrix.

19. Do the following using pointers

i) add two numbers

ii) swap two numbers using a user defined function

20. Input and Print the elements of an array using pointers

21. Compute sum of the elements stored in an array using pointers and user defined function.

22. Create a file and perform the following

iii) Write data to the file

iv) Read the data in a given file & display the file content on console

v) append new data and display on console

23. Open a text input file and count number of characters, words and lines in it; and store the results in an output file.

PHL 120	ENGINEERING PHYSICS LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		BSC	0	0	2	1	2019

Preamble: The aim of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to develop practical applications of engineering materials and use the principle in the right way to implement the modern technology.

Prerequisite: Higher secondary level Physics

Course Outcomes: After the completion of the course the student will be able to

CO 1	Develop analytical/experimental skills and impart prerequisite hands on experience for engineering laboratories
CO 2	Understand the need for precise measurement practices for data recording
CO 3	Understand the principle, concept, working and applications of relevant technologies and comparison of results with theoretical calculations
CO 4	Analyze the techniques and skills associated with modern scientific tools such as lasers and fiber optics
CO 5	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				3			1	2			1
CO 2	3				3			1	2			1
CO 3	3				3			1	2			1
CO 4	3				3			1	2			1
CO 5	3				3			1	2			1

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

LIST OF EXPERIMENTS

(Minimum 8 experiments should be completed)

1. CRO-Measurement of frequency and amplitude of wave forms
2. Measurement of strain using strain gauge and wheatstone bridge
3. LCR Circuit – Forced and damped harmonic oscillations
4. Melde's string apparatus- Measurement of frequency in the transverse and longitudinal mode
5. Wave length measurement of a monochromatic source of light using Newton's Rings method.
6. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
7. To measure the wavelength using a millimeter scale as a grating.
8. Measurement of wavelength of a source of light using grating.
9. Determination of dispersive power and resolving power of a plane transmission grating
10. Determination of the particle size of lycopodium powder
11. Determination of the wavelength of He-Ne laser or any standard laser using diffraction grating
12. Calculate the numerical aperture and study the losses that occur in optical fiber cable.
13. I-V characteristics of solar cell.
14. LED Characteristics.
15. Ultrasonic Diffractometer- Wavelength and velocity measurement of ultrasonic waves in a liquid
16. Deflection magnetometer-Moment of a magnet- Tan A position.

Reference books

1. S.L.Gupta and Dr.V.Kumar, "Practical physics with viva voice", Pragati PrakashanPublishers, Revised Edition, 2009

2. M.N.Avadhanulu, A.A.Dani and Pokely P.M, "Experiments in Engineering Physics", S.Chand&Co,2008

3. S. K. Gupta, "Engineering physics practicals", Krishna Prakashan Pvt. Ltd., 2014

4. P. R. Sasikumar "Practical Physics", PHI Ltd., 2011.

CYL 120	ENGINEERING CHEMISTRY LAB	CATEGORY	L	T	P	CREDIT
		BSC	0	0	2	1

Preamble: To impart scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters

Prerequisite: Experiments in chemistry introduced at the plus two levels in schools

Course outcomes: After the completion of the course the students will be able to

CO 1	Understand and practice different techniques of quantitative chemical analysis to generate experimental skills and apply these skills to various analyses
CO 2	Develop skills relevant to synthesize organic polymers and acquire the practical skill to use TLC for the identification of drugs
CO 3	Develop the ability to understand and explain the use of modern spectroscopic techniques for analysing and interpreting the IR spectra and NMR spectra of some organic compounds
CO 4	Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
CO 5	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
CO 6	Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economical and environmental problems and why it is an integral part of curriculum

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3				2							3
CO 2	3				3							3
CO 3	3				3							3
CO 4	3				3							3
CO 5	3				1							3
CO 6	3				1							3

Mark distribution

Total Marks	CIE marks	ESE marks	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

LIST OF EXPERIMENTS (MINIMUM 8 MANDATORY)

1. Estimation of total hardness of water-EDTA method
2. Potentiometric titration
3. Determination of cell constant and conductance of solutions.
4. Calibration of pH meter and determination of pH of a solution
5. Estimation of chloride in water
6. Identification of drugs using TLC
7. Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
8. Determination of molar absorptivity of a compound ($KMnO_4$ or any water soluble food colorant)
9. Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
10. Estimation of iron in iron ore
11. Estimation of copper in brass
12. Estimation of dissolved oxygen by Winkler's method
13. (a) Analysis of IR spectra (minimum 3 spectra) (b) Analysis of ^1H NMR spectra (minimum 3 spectra)
14. Flame photometric estimation of Na^+ to find out the salinity in sand
15. Determination of acid value of a vegetable oil
16. Determination of saponification of a vegetable oil

Reference Books

1. G. Svehla, B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson, 2012.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning, 2017.
3. Muhammed Arif, "Engineering Chemistry Lab Manual", Owl publishers, 2019.
4. Ahad J., "Engineering Chemistry Lab manual", Jai Publications, 2019.
5. Roy K Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers, 2019.
6. Soney C George, Rino Laly Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company Pvt Ltd, New Delhi, 2019.

ESL 120	CIVIL & MECHANICAL WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
			0	0	2	1	2019

Preamble: The course is designed to train the students to identify and manage the tools, materials and methods required to execute an engineering project. Students will be introduced to a team working environment where they develop the necessary skills for planning, preparing and executing an engineering project.

To enable the student to familiarize various tools, measuring devices, practices and different methods of manufacturing processes employed in industry for fabricating components.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to:

Course Outcome	Course Outcome Description
CO 1	Name different devices and tools used for civil engineering measurements
CO 2	Explain the use of various tools and devices for various field measurements
CO 3	Demonstrate the steps involved in basic civil engineering activities like plot measurement, setting out operation, evaluating the natural profile of land, plumbing and undertaking simple construction work.
CO 4	Choose materials and methods required for basic civil engineering activities like field measurements, masonry work and plumbing.
CO 5	Compare different techniques and devices used in civil engineering measurements
CO 6	Identify Basic Mechanical workshop operations in accordance with the material and objects
CO 7	Apply appropriate Tools and Instruments with respect to the mechanical workshop trades
CO 8	Apply appropriate safety measures with respect to the mechanical workshop trades

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	-	-	-	1	1	-	-	2	2	-	-
CO 2	1	-	-	-	1	1	-	-	2	2	-	-
CO 3	1	-	-	-	1	1	-	2	2	2	1	-
CO 4	1	-	-	-	1	1	-	2	2	2	1	1
CO 5	1	-	-	-	1	1	-	-	2	2		1
CO 6	2											

CO 7	2											
CO 8	2											

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hour

Assessment Procedure: Total marks allotted for the course is 100 marks. CIE shall be conducted for 70 marks and ESE for 30 marks. CIE should be done for the work done by the student and also viva voce based on the work done on each practical session. ESE shall be evaluated by written examination of one hour duration conducted internally by the institute.

Continuous Internal Evaluation Pattern:

Attendance : 20 marks
Class work/ Assessment /Viva-voce : 50 marks
End semester examination (Internally by college) : 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

SYLLABUS

PART 1

CIVIL WORKSHOP

Exercise 1. Calculate the area of a built-up space and a small parcel of land- Use standard measuring tape and digital distance measuring devices

Exercise 2. (a) Use screw gauge and vernier calliper to measure the diameter of a steel rod and thickness of a flat bar

(b) Transfer the level from one point to another using a water level

(c) Set out a one room building with a given plan and measuring tape

Exercise 3. Find the level difference between any two points using dumpy level

Exercise 4. (a) Construct a $1\frac{1}{2}$ thick brick wall of 50 cm height and 60 cm length using English bond. Use spirit level to assess the tilt of walls.

(b) Estimate the number of different types of building blocks to construct this wall.

Exercise 5. (a) Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves ,fixtures and sanitary fittings.

(b) Install a small rainwater harvesting installation in the campus

Reference Books:

1. Khanna P.N, "Indian Practical Civil Engineering Handbook", Engineers Publishers.
2. Bhavikatti. S, "Surveying and Levelling (Volume 1)", I.K. International Publishing House
3. Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications
4. S. C. Rangwala, "Engineering Materials," Charotar Publishing House.

PART II

MECHANICAL WORKSHOP

LIST OF EXERCISES

(Minimum EIGHT units mandatory and FIVE models from Units 2 to 8 mandatory)

UNIT 1:- General : Introduction to workshop practice, Safety precautions, Shop floor ethics, Basic First Aid knowledge.

Study of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc.

UNIT 2:- Carpentry : Understanding of carpentry tools

Minimum any one model

1. T –Lap joint 2. Cross lap joint 3. Dovetail joint 4. Mortise joints

UNIT 3:- Foundry : Understanding of foundry tools

Minimum any one model

1.Bench Molding 2. Floor Molding 3. Core making 4. Pattern making

UNIT 4: - Sheet Metal : Understanding of sheet metal working tools

Minimum any one model

1. Cylindrical shape
2. Conical shape
3. Prismatic shaped job from sheet metal

UNIT 5: - Fitting : Understanding of tools used for fitting

Minimum any one model

1. Square Joint
2. V- Joint
3. Male and female fitting

UNIT 6: - Plumbing : Understanding of plumbing tools, pipe joints

Any one exercise on joining of pipes making use of minimum three types of pipe joints

UNIT 7: - Smithy: Understanding of tools used for smithy.

Demonstrating the forge-ability of different materials (MS, Al, alloy steel and cast steels) in cold and hot states.

Observing the qualitative difference in the hardness of these materials

Minimum any one exercise on smithy

1. Square prism
2. Hexagonal headed bolt
3. Hexagonal prism
4. Octagonal prism

UNIT 8: -Welding: Understanding of welding equipments

Minimum any one welding practice

Making Joints using electric arc welding. bead formation in horizontal, vertical and over head positions

UNIT 9: - Assembly: Demonstration only

Dissembling and assembling of

1. Cylinder and piston assembly
2. Tail stock assembly
3. Bicycle
4. Pump or any other machine

UNIT 10: - Machines: Demonstration and applications of the following machines

Shaping and slotting machine; Milling machine; Grinding Machine; Lathe; Drilling Machine.

UNIT 11: - Modern manufacturing methods: Power tools, CNC machine tools, 3D printing, Glass cutting.

Course Contents and Lecture Schedule:

No	Topic	No of Sessions
1	**INTRODUCTION**	
1.1	Workshop practice, shop floor precautions, ethics and First Aid knowledge. Studies of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc	1
2	**CARPENTRY**	
2.1	Understanding of carpentry tools and making minimum one model	2

3	**FOUNDRY**	
3.1	Understanding of foundry tools and making minimum one model	2
4	**SHEET METAL**	
4.1	Understanding of sheet metal working tools and making minimum one model	2
5	**FITTING**	
5.1	Understanding of fitting tools and making minimum one model	2
6	**PLUMBING**	
6.1	Understanding of pipe joints and plumbing tools and making minimum one model	2
7	**SMITHY**	
7.1	Understanding of smithy tools and making minimum one model	2
8	**WELDING**	
8.1	Understanding of welding equipments and making minimum one model	2
9	**ASSEMBLY**	
9.1	Demonstration of assembly and dissembling of multiple parts components	1
10	**MACHINES**	
10.1	Demonstration of various machines	1
11	**MODERN MANUFACTURING METHODS**	
11.1	Demonstrations of: power tools, CNC Machine tools, 3D printing, Glass cutting	1

ESL 130	ELECTRICAL & ELECTRONICS WORKSHOP	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	0	0	2	1	2019

Preamble: Electrical Workshop is intended to impart skills to plan and carry out simple electrical wiring. It is essential for the practicing engineers to identify the basic practices and safety measures in electrical wiring.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Demonstrate safety measures against electric shocks.
CO 2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols
CO 3	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings
CO 4	Identify and test various electronic components
CO 5	Draw circuit schematics with EDA tools
CO 6	Assemble and test electronic circuits on boards
CO 7	Work in a team with good interpersonal skills

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	3	-	-	-	-	-	1
CO 2	2	-	-	-	-	-	-	-	-	1	-	-
CO 3	2	-	-	1	-	1	-	1	2	2	-	2
CO 4	3	-	-	-	-	-	-	-	-	-	-	2
CO 5	3	-	-	-	2	-	-	-	-	-	-	2
CO 6	3	-	-	-	2	-	-	-	-	-	-	1
CO 7	-	-	-	-	-	-	-	-	3	2	-	2

Mark distribution

Total Marks	CIE	ESE	ESE Duration(Internal)
100	100	-	1 hour

Continuous Internal Evaluation Pattern:

Attendance	: 20 marks
Class work/ Assessment /Viva-voce	: 50 marks
End semester examination (Internally by college)	: 30 marks

End Semester Examination Pattern: Written Objective Examination of one hour

Syllabus

PART 1

ELECTRICAL

List of Exercises / Experiments

1. a) Demonstrate the precautionary steps adopted in case of Electrical shocks.
   b)Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.
2. Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)
3. Wiring of light/fan circuit using Two way switches . (Staircase wiring)
4. Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6. a)Identify different types of batteries with their specifications.
   b)Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.

PART II

ELECTRONICS

List of Exercises / Experiments (Minimum of 7 mandatory)

1. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)

2. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as Dia or XCircuit), Interpret data sheets of discrete components and IC's, Estimation and costing.

3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station etc.]

4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]

5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]

6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]
7. Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
8. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning (**Any Two circuits).**

    1. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
    2. Square wave generation using IC 555 timer in IC base.
    3. Sine wave generation using IC 741 OP-AMP in IC base.
    4. RC coupled amplifier with transistor BC107.

SEMESTER III

MAT 203	DISCRETE MATHEMATICAL STRUCTURES	CATEGORY	L	T	P	CREDITS
		BSC	3	1	0	4

Preamble:

The purpose of this course is to create awareness in students about the basic terminologies used in advanced courses in Computer Science and develop rigorous logical thinking for solving different kinds of problems in Computer Science. This course helps the learner to apply the theory and applications of elementary Counting Principles, Propositional Logic, Predicate Logic, Lattices, Generating Functions, Recurrence Relations and Algebraic Structures eventually in practical applications.

Prerequisite: A sound background in higher secondary school Mathematics

Course Outcomes: After the completion of the course the student will be able to

CO#	CO
CO1	Check the validity of predicates in Propositional and Quantified Propositional Logic using truth tables, deductive reasoning and inference theory on Propositional Logic **(Cognitive Knowledge Level: Apply)**
CO2	Solve counting problems by applying the elementary counting techniques - Rule of Sum, Rule of Product, Permutation, Combination, Binomial Theorem, Pigeonhole Principle and Principle of Inclusion and Exclusion **(Cognitive Knowledge Level: Apply)**
CO3	Classify binary relations into various types and illustrate an application for each type of binary relation, in Computer Science (**Cognitive Knowledge Level: Understand)**
CO4	Illustrate an application for Partially Ordered Sets and Complete Lattices, in Computer Science **(Cognitive Knowledge Level: Apply)**
CO5	Explain Generating Functions and solve First Order and Second Order Linear Recurrence Relations with Constant Coefficients **(Cognitive Knowledge Level: Apply)**
CO6	Illustrate the abstract algebraic systems - Semigroups, Monoids, Groups, Homomorphism and Isomorphism of Monoids and Groups **(Cognitive Knowledge Level: Understand)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓	✓	✓								✓
CO3	✓	✓	✓	✓		✓						✓
CO4	✓	✓	✓	✓		✓						✓
CO5	✓	✓	✓	✓								✓
CO6	✓	✓	✓	✓								✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test 1 (%)	Test 2 (%)	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3

Continuous Internal Evaluation Pattern:

Attendance **10 marks**

Continuous Assessment Tests (Average of Series Tests 1 & 2) **25 marks**

Continuous Assessment Assignment **15 marks**

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 full questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module – 1 (Fundamentals of Logic)

Mathematical logic - Basic connectives and truth table, Statements, Logical Connectives, Tautology, Contradiction. Logical Equivalence - The Laws of Logic, The Principle of duality, Substitution Rules . The implication - The Contrapositive, The Converse,The Inverse.

Logical Implication - Rules of Inference. The use of Quantifiers - Open Statement, Quantifier. Logically Equivalent – Contrapositive, Converse , Inverse , Logical equivalences and implications for quantified statement, Implications , Negation .

Module - 2 (Fundamentals of Counting Theory)

The Rule of Sum – Extension of Sum Rule . The Rule of Product - Extension of Product Rule . Permutations. Combinations. The Binomial Theorem (without proof). Combination with Repetition. The Pigeon hole Principle. The Principle of Inclusion and Exclusion Theorem (Without Proof) - Generalization of the Principle. Derangements.

Module - 3 (Relations and Functions)

Cartesian Product - Binary Relation. Function – domain , range-one to one function, Image-restriction. Properties of Relations- Reachability Relations, Reflexive Relations, Symmetric Relations, Transitive relations, Anti-symmetric Relations, Partial Order relations, Equivalence Relations, Irreflexive relations.

Partially ordered Set – Hasse Diagram, Maximal-Minimal Element, Least upper bound (lub), Greatest Lower bound(glb) (Topological sorting Algorithm- excluded). Equivalence Relations and Partitions - Equivalence Class.

Lattice - Dual Lattice , Sub lattice , Properties of glb and lub , Properties of Lattice , Special Lattice , Complete Lattice, Bounded Lattice, Completed Lattice , Distributive Lattice.

Module - 4 (Generating Functions and Recurrence Relations)

Generating Function - Definition and Examples , Calculation techniques, Exponential generating function. First order linear recurrence relations with constant coefficients – homogeneous, non-homogeneous Solution. Second order linear recurrence relations with constant coefficients, homogeneous, non-homogeneous Solution.

Module - 5 (Algebraic Structures)

Algebraic system-properties- Homomorphism and Isomorphism. Semi group and monoid – cyclic monoid , sub semi group and sub monoid, Homomorphism and Isomorphism of Semi group and monoids. Group- Elementary properties, subgroup, symmetric group on three symbols ,The direct product of two groups, Group Homomorphism, Isomorphism of groups, Cyclicgroup. Rightcosets - Leftcosets. Lagrange's Theorem

Text Book

1. Discrete and Combinatorial Mathematics (An Applied Introduction), Ralph P Grimaldi, B V Ramana , 5th Edition, Pearson

Reference Books

1) Kenneth H. Rosen, Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, Seventh Edition, MGH, 2011
2) Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 2003.
3) Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Pearson Education Pvt Ltd., New Delhi, 2003
4) Kenneth H .Rosen, "Discrete Mathematics and its Applications", 5/e, Tata Mc Graw Hill Pub. Co. Ltd, New Delhi 2003
5) Richard Johnsonbaugh, "Discrete Mathematics", 5/e, Pearson Education Asia, NewDelhi, 2002.
6) Joe L Mott, Abraham Kandel, Theodore P Baker,"Discrete Mathematics for Computer Scientists and Mathematicians", 2/e, Prentice-Hall India, 2009.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Show that $R \vee M$, $\neg R \vee S$, $\neg M$, $\neg S$ cannot exist simultaneously (without using truth table)
2. Represent the following statement in symbolic form "Not every city in Canada is clean".

Course Outcome 2 (CO2):

1. How many possible arrangements are there for the letters in MASSASAUGA in which 4 A' s are together?
2. Find the number of integers between 1 and 1000 inclusive, which are not divisible by 5, 6 or 8

Course Outcome 3 (CO3):

1. If A = {1, 2, 3, 4}, give an example of a relation R that is reflexive and symmetric but not transitive.
2. Let Z be the set of integers. R is a relation called "Congruence Modulo 3 " defined by R = { (x,y) /x ε Z,y ε Z, x - y is divisible by 3 } . Show that R is an equivalence relation.

Course Outcome 4 (CO4):

1. Assume A ={ a, b, c}. Let P(A) be its power set and '$\leq$ ' be the subset relation on the power set. Draw the Hasse diagram of (P(A), $\leq$).
2. What is meant by Bounded Lattice ? Give an example.

Course Outcome 5 (CO5):

1. Solve $a_r - 3a_{r-1} - 4a_{r-2} = 3^r$ using Generating function method; Given $a_0 = 1$, $a_1 = 2$.
2. Find the generating function for the sequence 1, 3, 3^2, 3^3 …….

Course Outcome 6 (CO6):

1. Prove that the group { 1,-1, i, -i } is cyclic with generators i and –i.
2. State and prove Lagrange's Theorem.

Model Question Paper

QP CODE:

Reg No:_____

Name :_____ **PAGES : 3**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MAT 203

Course Name: Discrete Mathematical Structures

Max.Marks :100 **Duration: 3 Hrs**

PART A

Answer all Questions. Each question carries 3 Marks

1. Show the following implication without constructing the truth table: (P ^ Q) => P→Q
2. Write the negation of the following statement. " If I drive, then I will not walk"
3. What is pigeon hole principle? Explain. If you select any five numbers from 1 to 8 then prove that at least two of them will add up to 9 .
4. In how many ways can the letters of the word ALLAHABAD be arranged ?
5. Show that the divisibility relation ' / ' is a partial ordering on the set Z^+.
6. Consider the functions given by f(x) = 2x+3 and g(x) = x^2. Find (g o f) and (f o g).
7. What is meant by exponential generating function? Explain.
8. Provide one example of linear homogeneous recurrence relation. Mention the degree also.
9. What is a monoid ? Explain.
10. Let (A, .) be a group. Show that $(ab)^{-1} = b^{-1}a^{-1}$

(10 x 3 = 30 Marks)

PART B

(Answer any one Question from each Module. Each question carries 14 Marks)

11.

(a) Show that S ∨ R is tautologically implied by (PVQ) ∧ (P→R) ∧ (Q→S)

(6 marks)

(b) Show that from

(ii) $(\exists x)(F(x) \wedge S(x)) \rightarrow (y)\,(M(y) \rightarrow W(y))$.

(iii)$(\exists y)\,(M(y) \wedge \neg W(y))$ the conclusion $(x)(F(x) \rightarrow \neg S(x))$ follows.

(8 marks)

OR

12.

(a) Show that $(x)\,(P(x) \vee Q(x)) \Rightarrow ((x)P(x) \vee (\exists x)\,Q(x))$ using indirect method of proof .

(6 marks)

(b) Discuss indirect method of proof . Show that the following premises are inconsistent

(i) If Jack misses many classes through illness, then he fails high school.

(ii) If Jack fails high school, then he is uneducated.

(iii)If Jack reads a lot of books, then he is not uneducated.

(iv) Jack misses many classes through illness and reads a lot of books.

(8 marks)

13.

(a) Explain binomial theorem. Determine the coefficient of x^9y^3 in the expansion of $(x+y)^{12}$, $(x+2y)^{12}$ and $(2x-3y)^{12}$ using binomial theorem.

(6 marks)

(b) How many 5 digit numbers can be formed from the digits 1,2,3,4,5 using the digits without repetition ?

(i) How many of them are even?

(ii) How many are even and greater than 30,000?

(8 marks)

OR

14.

(a) There are 8 guests in a party. Each guest brings a gift and receives another gift in return. No one is allowed to receive the gift they bought. How many ways are there to distribute the gifts?

(6 marks)

(b) Six papers are set in an examination of which two are mathematical. Only one examination will be conducted in a day. In how many different orders ,can the papers be arranged so that

(i) Two mathematical papers are consecutive?

(ii) Two mathematical papers are not consecutive?

(8 marks)

15.

(a) Let A = { 1,2,3,4,...11,12} and let R be the equivalence relation on A x A defined by (a,b) R (c,d) iff a+d = b+c. Prove that R is an equivalence relation and find the equivalence class of (2 ,5)

(8 marks)

(b) What is a chain lattice ? Explain. Also show that every chain is a distributive lattice.

(6 marks)

OR

16.

(a) Suppose f(x) = x+2 , g(x) = x-2, and h(x) = 3x for x ε R , where R is the set of real numbers. Find (g o f) , (f o g) , (f o f) and (g o g)

(8 marks)

(b) Let R and S be two relations on a set A . If R and S are symmetric, Prove that (R∩S) is also symmetric.

(6 marks)

17.

(a) Solve the recurrence relation $a_r - 7a_{r-1} + 10a_{r-2} = 0$ for $r \geq 2$; Given $a_0 = 0$; $a_1 = 41$ using generating functions

(8 marks)

(b) Solve the recurrence relation $a_r - 4a_{r-1} + 4a_{r-2} = (r+1)^2$ using generating function.

(6 marks)

OR

18.

(a) Solve $a_n - 3a_{n-1} + 2$; $a_0 = 1$ $n \geq 1$, using generating functions.

(8 marks)

(b) Use generating function to solve the following recurrence relation $a_n = 2a_{n-1} + 2^n$; with $a_0 = 2$.

(6 marks)

19.

(a) Prove that the set 'Q' of rational numbers other than 1 forms an abelian group with respect to the operation ' * ' defined by a * b = a+b -ab.

(8 Marks)

(b) Show that the direct product of two group is a group.

(6 Marks)

OR

20.

(a) Show that the subgroup of a cyclic group is cyclic.

(8 Marks)

(b) Let (A,*) be a group. Show that (A,*) is an abelian group if and only if $a^2 * b^2 = (a*b)^2$ for all 'a' and 'b' in A

(6 Marks)

TEACHING PLAN

No	Contents	No of Lecture Hrs
Module – 1 (Fundamentals of Logic) (9 hrs)		
1.1	Mathematical logic, Basic Connectives and Truth Table	1
1.2	Statements, Logical Connectives, Tautology, Contradiction	1
1.3	Logical Equivalence, The Laws of Logic	1
1.4	The Principle of duality, Substitution Rules	1
1.5	The implication, The Contrapositive, the Converse , the Inverse	1
1.6	Logical Implication,Rules of Inference, Logical Implication	1
1.7	The use of Quantifiers, Open Statement, Quantifier, Negation	1
1.8	Logically Equivalent, Contrapositive, The Converse, The Inverse	1
1.9	Logical Implications	1
Module - 2 (Fundamentals of Counting Theory) (9 hrs)		
2.1	The Pigeon-hole Principle	1
2.2	The Rule of Sum	1
2.3	Extension of Sum Rule	1
2.4	The Rule of Product	1
2.5	Extension of Product Rule , Permutations	1
2.6	Combinations, Combination with repetition	1
2.7	The Binomial Theorem	1
2.8	The Principle of Inclusion and Exclusion Theorem (Without Proof) Generalization of the Principle	1
2.9	Derangements	1
Module - 3 (Relations and Functions) (9 hrs)		
3.1	Cartesian Product, Binary Relation, Function, Domain, Range , One to One Function Image - Restriction	1
3.2	Properties, Reachability Relations, Reflexive Relations,Symmetric Relations,Transitive relations, Antisymmetric Relations.	1

3.3	Partial Order relations	1
3.4	Equivalence Relation, Irreflexive Relations.	1
3.5	Partially ordered Set, Hasse Diagram.	1
3.6	Maximal-Minimal Element, Least Upper bound, Greatest Lower Bound	1
3.7	Equivalence Relations and Partitions ,Equivalence Class	1
3.8	Lattice- Dual Lattice,sub lattice , Properties of glb and lub	1
3.9	Properties of Lattice , Special Lattice , Complete Lattice, Bounded Lattice, Completed Lattice, Distributive Lattice	1
Module - 4 (Generating Functions and Recurrence Relations) (9 hrs)		
4.1	Generating Function , Definition and Examples	1
4.2	Exponential Generating Function.	1
4.3	First Order Linear Recurrence Relations with Constant Coefficients (Lecture I)	1
4.4	First Order Linear Recurrence Relations with Constant Coefficients (Lecture II)	1
4.5	Homogeneous Solution	1
4.6	Non homogeneous Solution	1
4.7	Second order linear recurrence relations with constant coefficients	1
4.8	Homogeneous Solution	1
4.9	Non homogeneous Solution	1
Module - 5 (Algebraic Structures)(9 hrs)		
5.1	Algebraic System-Properties, Homomorphism and Isomorphism	1
5.2	Semi group , Monoid, Cyclic monoid	1

5.3	Sub semigroup and sub monoid	1
5.4	Homomorphism and Isomorphism of Semigroup, Monoids and Groups	1
5.5	Elementary Properties, Subgroup, Symmetric group on three symbols	1
5.6	The direct Product of two Groups	1
5.7	Group Homomorphism, Isomorphism, Cyclic group	1
5.8	Right coset, Left coset	1
5.9	Lagrange's Theorem	1

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
KTU
Estd.
2014

CST201	DATA STRUCTURES	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	1	0	4	2019

Preamble: This course aims at moulding the learner to understand the various data structures, their organization and operations. The course helps the learners to assess the applicability of different data structures and associated algorithms for solving real world problem which requires to compare and select appropriate data structures to solve the problem efficiently. This course introduces abstract concepts for data organization and manipulation using data structures such as stacks, queues, linked lists, binary trees, heaps and graphs for designing their own data structures to solve practical application problems in various fields of Computer Science.

Prerequisite: Topics covered under the course Programming in C (EST 102)

CO1	Design an algorithm for a computational task and calculate the time/space complexities of that algorithm **(Cognitive Knowledge Level: Apply)**
CO2	Identify the suitable data structure (array or linked list) to represent a data item required to be processed to solve a given computational problem and write an algorithm to find the solution of the computational problem **(Cognitive Knowledge Level: Apply)**
CO3	Write an algorithm to find the solution of a computational problem by selecting an appropriate data structure (binary tree/graph) to represent a data item to be processed **(Cognitive Knowledge Level: Apply)**
CO4	Store a given dataset using an appropriate Hash Function to enable efficient access of data in the given set **(Cognitive Knowledge Level: Apply)**
CO5	Select appropriate sorting algorithms to be used in specific circumstances (Cognitive Knowledge Level: **Analyze**)
CO6	Design and implement Data Structures for solving real world problems efficiently **(Cognitive Knowledge Level: Apply)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓		✓						✓
CO2	✓	✓	✓	✓		✓						✓
CO3	✓	✓	✓	✓		✓						✓
CO4	✓	✓	✓	✓		✓						✓
CO5	✓	✓	✓	✓		✓						✓
CO6	✓	✓	✓	✓		✓						✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test1 (Percentage)	Test2 (Percentage)	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40

Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**50**	**100**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Tests : 25 marks

Continuous Assessment Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks

First Internal Examination shall be preferably conducted after completing the first half of the syllabus and the Second Internal Examination shall be preferably conducted after completing remaining part of the syllabus.

There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly covered module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly covered module), each with 7 marks. Out of the 7 questions in Part B, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

Module 1

Basic Concepts of Data Structures

System Life Cycle, Algorithms, Performance Analysis, Space Complexity, Time Complexity, Asymptotic Notation, Complexity Calculation of Simple Algorithms

Module 2

Arrays and Searching

Polynomial representation using Arrays, Sparse matrix, Stacks, Queues-Circular Queues, Priority Queues, Double Ended Queues, Evaluation of Expressions

Linear Search and Binary Search

Module 3

Linked List and Memory Management

Self Referential Structures, Dynamic Memory Allocation, Singly Linked List-Operations on Linked List. Doubly Linked List, Circular Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List

Memory allocation and de-allocation-First-fit, Best-fit and Worst-fit allocation schemes

Module 4

Trees and Graphs

Trees, Binary Trees-Tree Operations, Binary Tree Representation, Tree Traversals, Binary Search Trees- Binary Search Tree Operations

Graphs, Representation of Graphs, Depth First Search and Breadth First Search on Graphs, Applications of Graphs

Module 5

Sorting and Hashing

Sorting Techniques – Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort

Hashing- Hashing Techniques, Collision Resolution, Overflow handling, Hashing functions – Mid square, Division, Folding, Digit Analysis

Text Book

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Universities Press, Fundamentals of Data Structures in C

Reference Books

1. Samanta D., Classic Data Structures, Prentice Hall India.
2. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, 2/e, Cengage Learning.
3. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.
4. Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill.
5. Peter Brass, Advanced Data Structures, Cambridge University Press.
6. Lipschuts S., Theory and Problems of Data Structures, Schaum's Series.
7. Wirth N., Algorithms + Data Structures = Programs, Prentice Hall.
8. Hugges J. K. and J. I. Michtm, A Structured Approach to Programming, PHI.
9. Martin Barrett, Clifford Wagner, C And Unix: Tools For Software Design, John Wiley.

Sample Course Level Assessment Questions

Course Outcome1(CO1): Write an algorithm for matrix multiplication and calculate its time complexity.

Course Outcome 2(CO2): How a linked list can be used to represent the polynomial $5x^4y^6+24x^3y^4-17x^2y^3+15xy^2+45$.Write an algorithm to add two Bivariate polynomials represented using linked list.

Course Outcome 3(CO3): Create a Binary search Tree with node representing the following sequence 14, 15, 4, 18, 9, 16, 20, 17, 3, 7, 5, 2 and perform inorder, preorder and postorder traversals on the above tree and print the output.

Course Outcome 4(CO4): The size of a hash table is 7. The index of the hash table varies from 0 to 6. Consider the keys 89, 18, 49, 58, 25 in the order. Show how the keys are stored in the hash table using Linear probing.

Course Outcome 5(CO5): In what circumstances does Quick Sort perform over Merge sort.

Course Outcome 6(CO6): Design a reservation system for railways that include waiting list. If the reservation is full "Display reservation full" and put the passenger in in waiting list and give a waiting list number. If a passenger cancels the ticket, then the seat should be automatically allocated to the first passenger in the waiting list.

Model Question Paper

QP CODE: PAGES:3

Reg No:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST201

Course Name: DATA STRUCTURES

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Calculate the frequency count of the statement x = x+1; in the following code segment

   for (i = 0; i< n; i++)

   for (j = 0; j< n; j*=2)

   x = x + 1;

2. What is the relevance of verification in System Life Cycle?

3. Write an algorithm to insert a new element in a particular position of an array.

4. Convert the expression ((A/(B-D+E))*(F-G)*H) to postfix form. Show each step in the conversion including the stack contents

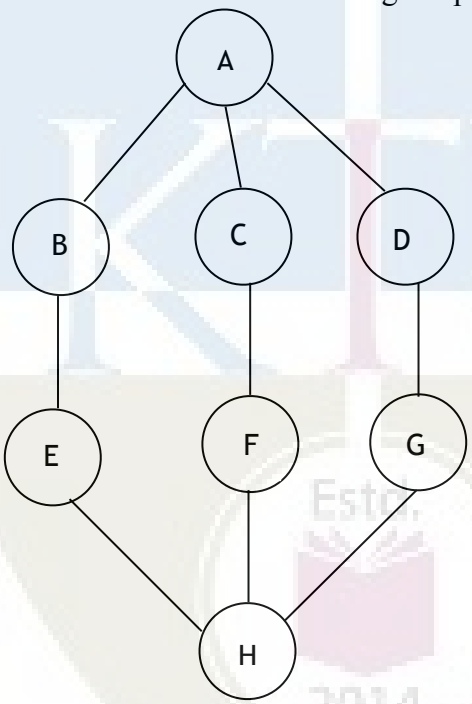
5. Write an algorithm to count the number of occurrences of a character in a linked list (each node contains only one character)

6. Write an algorithm for best-fit method of memory allocation

7. Draw the binary tree whose sequential representation is given below

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	B	C	-	D	E	-	-	-	-	F	G	-	-	-

8. Find the Depth First Search of the following Graph



9. Write an algorithm to arrange n numbers in nonincreasing order.

10. Let the size of a hash table is 10. The index of the hash table varies from 0 to 9. Assume the keys 73, 54, 15, 48, 89, 66, 37, 18, 41, 22, 62 are mapped using modulo operator. Show how the keys are distributed using chaining method.

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. a) Explain the System Life Cycle in detail (10)

    b) How the performance of an algorithm is evaluated? (4)

OR

12. a) Write algorithms for Linear Search and Binary Search and Compare their time complexities (10)

    b) Between O(nlogn) and O(logn) which one is better and why? (4)

13. a) Write algorithms to insert and delete elements from a double ended queue. Demonstrate with examples (10)

    b) Compare and contrast Circular Queue with a Normal Queue (4)

OR

14. a) Write an algorithm to insert and delete elements from a Priority Queue (8)

    b) Discuss an algorithm to convert an infix expression to a prefix expression (6)

15. a) Write an algorithm to multiply two polynomials represented using linked list (10)

    b) How doubly linked list can be used to find palindromes ? (4)

OR

16. a) How is memory compaction (de-allocation) done in memory management ? (8)

    b) Discuss the advantages and disadvantages of First-fit, Best-fit and Worst-fit allocation schemes (6)

17. a) List the properties of Binary Search Tree. Write an algorithm to search an element from a Binary Search Tree (10)

b) Write an iterative algorithm for in-order traversal of a Binary Tree (4)

OR

18. a) Give algorithms for DFS and BFS of a graph and explain with examples (8)

b) How graphs can be represented in a Computer? (6)

19. a) Write algorithms for Merge sort and Quick Sort. (10)

b) Illustrate the working of Quick sort on the following input 38, 8, 0, 28, 45, -12, 89, 66, 42 (4)

OR

20. a) With examples discuss the different hash functions used for hashing (10)

b) Apply the hash function h(x) = x mod 7 for linear probing on the data 2341, 4234, 2839, 430, 22, 397, 3920 and show the resulting hash table (4)

Teaching Plan		
Module 1 :Basic Concepts of Data Structures		(5 hours)
1.1	System Life Cycle,	1 hour
1.2	Algorithms , Performance Analysis	1 hour
1.3	Space Complexity, Time Complexity	1 hour
1.4	Asymptotic Notation (Big O Notation)	1 hour
1.5	Complexity Calculation of Simple Algorithms	1hour
Module 2 :**Arrays and Searching**		(10 hours)
2.1	Polynomial representation using Arrays	1 hour
2.2	Sparse matrix (Lecture 1)	1 hour
2.3	Sparse matrix (Lecture 2)	1 hour

2.4	Stacks	1 hour
2.5	Queues, Circular Queues	1 hour
2.6	Priority Queues,	1 hour
2.7	Double Ended Queues,	1 hour
2.8	Conversion and Evaluation of Expressions (Lecture 1)	1 hour
2.9	Conversion and Evaluation of Expressions (Lecture 2)	1 hour
2.10	Linear Search and Binary Search	1 hour
Module 3 : **Linked List and Memory Management**		(12 hours)
3.1	Self Referential Structures	1 hour
3.2	Dynamic Memory Allocation	1 hour
3.3	Singly Linked List-Operations on Linked List,	1 hour
3.4	Doubly Linked List	1 hour
3.5	Circular Linked List	1 hour
3.6	Stacks using Linked List	1 hour
3.7	Queues using Linked List	1 hour
3.8	Polynomial representation using Linked List (Lecture 1)	1 hour
3.9	Polynomial representation using Linked List (Lecture2)	1 hour
3.10	Memory de-allocation	1 hour
3.11	Memory allocation-First-fit	1 hour
3.12	Best-fit and Worst-fit allocation schemes	1hour
Module 4 :**Trees and Graphs**		(8 hours)
4.1	Trees, Binary Trees	1hour
4.2	Tree Operations, Binary Tree Representation,	1hour
4.3	Tree Traversals	1hour
4.4	Binary Search Trees	1hour
4.5	Binary Search Tree Operations	1hour
4.6	Graphs, Representation of Graphs	1hour

4.7	Depth First Search and Breadth First Search on Graphs	1hour
4.8	Applications of Graphs	1hour
Module 5 : **Sorting and Hashing**		(10 hours)
5.1	Sorting Techniques – Selection Sort	1hour
5.2	Insertion Sort	1hour
5.3	Quick Sort	1hour
5.4	Merge Sort	1hour
5.5	Heap Sort	1hour
5.6	Hashing- Hashing Techniques	1hour
5.7	Collision Resolution	1hour
5.8	Overflow handling	1hour
5.9	Hashing functions – Mid square and Division methods	1hour
5.10	Folding and Digit Analysis methods	1hour

CST 203	LOGIC SYSTEM DESIGN	Category	L	T	P	Credit	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: The objective of the course is to familiarize learners with the basic concepts of Boolean algebra and digital systems. This course covers the design of simple combinational and sequential logic circuits, representation and arithmetic algorithms for Binary, BCD (Binary Coded Decimal) and Floating point numbers which in turn are helpful in understanding organization & design of a computer system and understanding how patterns of ones and zeros can be used to store information on computers, including multimedia data.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO#	CO
CO1	Illustrate decimal, binary, octal, hexadecimal and BCD number systems, perform conversions among them and do the operations - complementation, addition, subtraction, multiplication and division on binary numbers (**Cognitive Knowledge level: Understand**)
CO2	Simplify a given Boolean Function and design a combinational circuit to implement the simplified function using Digital Logic Gates (**Cognitive Knowledge level: Apply**)
CO3	Design combinational circuits - Adders, Code Convertors, Decoders, Magnitude Comparators, Parity Generator/Checker and design the Programmable Logic Devices - ROM and PLA. **(Cognitive Knowledge level: Apply)**
CO4	Design sequential circuits - Registers, Counters and Shift Registers. **(Cognitive Knowledge level: Apply)**
CO5	Use algorithms to perform addition and subtraction on binary, BCD and floating point numbers **(Cognitive Knowledge level: Understand)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										✓
CO2	✓	✓	✓	✓		✓						✓
CO3	✓	✓	✓	✓		✓						✓
CO4	✓	✓	✓	✓		✓						✓
CO5	✓	✓	✓									✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern:

Bloom's Category	Test 1 (%)	Test 2 (%)	End Semester Examination Marks (%)
Remember	20	20	20
Understand	35	35	35
Apply	45	45	45
Analyse			
Evaluate			
Create			

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test : 25 marks
Continuous Assessment Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

Module I

Number systems, Operations & Codes

Decimal, Binary, Octal and Hexadecimal Number Systems- Number Base Conversions. Addition, Subtraction, Multiplication and Division of binary numbers. Representation of negative numbers- Complements, Subtraction with complements. Addition and subtraction of BCD, Octal and Hexadecimal numbers. Binary codes- Decimal codes, Error detection codes, Reflected code, Character coding schemes – ASCII, EBCDIC.

Module II

Boolean Algebra

Postulates of Boolean Algebra. Basic theorems and Properties of Boolean Algebra. Boolean Functions - Canonical and Standard forms. Simplification of Boolean Functions- Using Karnaugh- Map Method (upto five variables), Don’t care conditions, Product of sums

simplification, Tabulation Method. Digital Logic Gates- Implementation of Boolean functions using basic and universal gates.

Module III

Combinational Logic Circuits

Design Procedure & Implementation of combinational logic circuits- Binary adders and subtractors, Binary Parallel adder, Carry look ahead adder, BCD adder, Code converter, Magnitude comparator, Decoder, Demultiplexer, Encoder, Multiplexer, Parity generator/ Checker.

Module IV

Sequential logic circuits:

Flip-flops- SR, JK, T and D. Triggering of flip-flops- Master slave flip- flops, Edge- triggered flip- flops. Excitation table and characteristic equation. Registers- register with parallel load. Counter design: Asynchronous counters- Binary and BCD counters, timing sequences and state diagrams. Synchronous counters- Binary Up- down counter, BCD counter.

Module V

Shift registers

Shift registers – Serial In Serial Out, Serial In Parallel Out, Bidirectional Shift Register with Parallel load. Ring counter. Johnson counter- timing sequences and state diagrams.

Arithmetic algorithms

Algorithms for addition and subtraction of binary numbers in signed magnitude and 2's complement representations. Algorithm for addition and subtraction of BCD numbers. Representation of floating point numbers, Algorithm for addition and subtraction of floating point numbers.

Programmable Logic devices

ROM. Programmable Logic Array(PLA)- Implementation of simple circuits using PLA.

Text Books:

1. M. Morris Mano, Digital Logic & Computer Design, 4/e, Pearson Education, 2013
2. Thomas L Floyd, Digital Fundamentals, 10/e, Pearson Education, 2009.
3. M. Morris Mano, Computer System Architecture, 3/e, Pearson Education, 2007.

Reference Books:

1. M. Morris Mano, Michael D Ciletti , Digital Design With An Introduction to the Verilog HDL, 5/e, Pearson Education, 2013.
2. Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003

Sample Course Level Assessment Questions

Course Outcome1(CO1): Perform the following number base conversions:

a) $(250.55)_{10}$ to Hexadecimal b) $(357)_8$ to Decimal

Course Outcome 2(CO2): Given a Boolean function F and don't care conditions D, using Karnaugh map obtain the simplified expression in (i) SOP and (ii) POS:

$$F(A, B, C, D) = A'B'D' + A'CD + A'BC$$
$$D(A, B, C, D) = A'BC'D + ACD + AB'D$$

Course Outcome 3(CO3): Design a BCD to Excess-3 Code Convertor.

Course Outcome 4(CO4): Design a 4- bit binary ripple counter.

Course Outcome 5(CO5): Demonstrate floating-point addition algorithm.

Model Question Paper

QP CODE: PAGES: 2

Reg No:_____
Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST 203

Course name : LOGIC SYSTEM DESIGN

Max Marks: 100 **Duration: 3 Hours**

PART-A

(Answer All Questions. Each question carries 3 marks)

1. Represent the decimal numbers $(459)_{10}$ and $(859)_{10}$ in hexadecimal and perform addition of these hexadecimal numbers.
2. Subtract $(1101)_2$ from $(11010)_2$ using: i) $2's$ complement and ii) $1's$ complement arithmetic.
3. Find the dual and complement of the boolean function $F = AB' + B(A + B')$.
4. Using K-map, reduce the expression: $AB + ABC + ABC + BC$.
5. Design a half subtractor with NAND gates only.
6. Design a combinational circuit that multiplies an input decimal digit by 5 represented in BCD. The output is also in BCD. Show that the outputs can be obtained from the input lines without using any logic gates.
7. Differentiate between ripple counter and synchronous counter.
8. Construct D flip- flop using NAND gates. Also give its truth table.
9. Explain how a shift register is used for serial data transfer?
10. Write short notes on ROM.

PART-B

(Answer any one full question from each module) **(14X5=70)**

11. (a) Perform the following operations using 2's complement arithmetic: (8)

(i) $88_{10} + (-37)_{10}$ (ii) $(-20)_{10} + (-12)_{10}$

(b) Perform the following base conversions: (i) $(101011.11)_2$ to octal (6)
(ii) $(3F9B)_{16}$ to binary (iii) $(121)_{10}$ to binary (iv) $(3077)_8$ to binary

OR

12. (a) Find the 12 bit $2's$ complement representation of the following decimal numbers. (6)

(i) – 97 (ii) – 224 (iii) - 197.5

(b) Perform the following operations (8)

(i) $(520)_8 + (488)_8$ (ii) $(520)_{16} - (488)_{16}$

13. (a) Prove that (i) $AB + A(B + C) + B(B + C) = B + AC$ (4)

(ii) $AB + A(B + C) + B(B + D) = A$

(b) Using K-map, simplify the Boolean function F in sum of products form, using the don't care conditions d: (10

$F(w, x, y, z) = w'(x'y + x'y' + xyz) + x'z'(y + w)$

$d(w, x, y, z) = w'x(y'z + yz') + wyz$

OR

14. (a) Simplify the following expressions using Karnaugh- map method. (8)

(i) $F = \Sigma(0,2,4,6,9,11,13,15,17,21,25,27,29,31)$

(ii) $F = \Pi(0,2,5,7)$

(b) Convert the following to the other canonical form: (6)

(i) $F(x, y, z, a) = \sum (1,3,7)$

(ii) $F(x, y, z) = \Pi(0,3,6,7)$

(iii) $F(A, B, C, D) = \Pi(0,1,2,3,4,6,12)$

15. (a) Implement Full adder circuit using NAND gate only. (4)

(b) Design a code converter for converting BCD to Excess 3 code (10)

OR

16. (a) With a neat diagram explain 4-bit carry look-ahead adder. (6)

(b) Design a Gray to binary code converter using a 4x1 MUX. Draw the circuit diagram and explain. (8)

17. (a) Design a counter that count the states 0,3,5,6,0… using T flip- flops. (10)

(b) Write the characteristics equation, excitation table of JK, T and D flipflop. (4)

OR

18. (a) Explain race around condition and how it can be avoided. (6)

(b) Design a synchronous Binary Up-Down Counter. (8)

19. (a) With a neat diagram explain universal shift register. (8)

(b) Explain Johnson Counter with timing diagram. (6)

OR

20. (a) Write algorithm for floating point addition and subtraction. (8)

(b) Implement the functions $Y_1 = AB'C' + AB'C + ABC$ and $Y_2 = BC + AC$ using minimum gates Programmable Logic Array. (6)

Teaching Plan

Module 1: Number systems, Operations & Codes (No algorithms)		**(7 hours)**
1.1	**Number Systems**: Decimal, Binary, Octal and Hexadecimal number systems, Number Base Conversions.	**1 hour**
1.2	**Binary Arithmetic:** Addition, Subtraction, Multiplication & Division of Binary Numbers. (Lecture 1)	**1 hour**
1.3	Addition, Subtraction, Multiplication & Division of Binary Numbers. (Lecture 2)	**1 hour**
1.4	Representation of Negative Numbers- Complements, subtraction with complements.	**1 hour**
1.5	**BCD Arithmetic:** Addition and Subtraction of BCD Numbers	**1 hour**
1.6	**Octal and Hexadecimal Arithmetic**: Addition & Subtraction of Octal and Hexadecimal Numbers.	**1 hour**

1.7	**Binary Codes:** Decimal Codes, Error detection codes, Reflected code, Character Coding Schemes-ASCII, EBCDIC	**1 hour**
Module 2: Boolean Algebra		**(9 hours)**
2.1	**Introduction to Boolean Algebra:** Postulates of Boolean Algebra	**1 hour**
2.2	Basic theorems and Properties of Boolean Algebra	**1 hour**
2.3	**Boolean Functions:** Canonical and Standard Forms	**1 hour**
2.4	**Simplification of Boolean Functions**: Karnaugh -Map Method (upto five variables), Don't care conditions (Lecture 1)	**1 hour**
2.5	**Simplification of Boolean Functions**: Karnaugh -Map Method (upto five variables), Don't care conditions (Lecture 2)	**1 hour**
2.6	**Product of sums simplification**	**1 hour**
2.7	**Tabulation method**	**1 hour**
2.8	**Digital Logic Gates:** AND, OR, NOT, NAND, NOR, XOR, XNOR, Implementation of Boolean functions using basic and universal gates. (Lecture 1)	**1 hour**
2.9	**Digital Logic Gates:** AND, OR, NOT, NAND, NOR, XOR, XNOR, Implementation of Boolean functions using basic and universal gates. (Lecture 2)	**1 hour**
Module 3: Combinational Logic Circuits		**(9 hours)**
3.1	Design Procedure & Implementation of Combinational Circuits	**1 hour**
3.2	**Binary Adders:** Implementation of Half Adder, Full Adder	**1 hour**
3.3	**Binary Subtractors:** Implementation of Half Subtractor, Full Subtractor	**1 hour**
3.4	Implementation of Binary Parallel Adder ,Carry look ahead Adder, BCD Adder (Lecture 1)	**1 hour**
3.5	Implementation of Binary Parallel Adder ,Carry look ahead Adder, BCD Adder (Lecture 2)	**1 hour**

3.6	**Implementation of Various Combinational Circuits:** Code Converters, Magnitude Comparator	**1 hour**
3.7	Implementation of Decoder, Demultiplexer	**1 hour**
3.8	Implementation of Encoder, Multiplexer	**1 hour**
3.9	Implementation of Parity Generator/Checker	**1 hour**
Module 4: Sequential logic circuits:		**(9 hours)**
4.1	**Flip flops:** SR, JK, T and D flip- flops (Lecture 1)	**1 hour**
4.2	SR, JK, T and D flip- flops (Lecture 2)	**1 hour**
4.3	Triggering of flip-flops- Master slave flip- flop, Edge- triggered flip-flops (Lecture 1)	**1 hour**
4.4	Triggering of flip-flops- Master slave flip- flop, Edge- triggered flip-flops (Lecture 2)	**1 hour**
4.5	Excitation table and characteristic equations of flip- flops	**1 hour**
4.6	**Registers-** Register with parallel load	**1 hour**
4.7	**Counter Design:** Asynchronous counters- Binary and BCD counters- timing sequences and state diagrams. (Lecture 1)	**1 hour**
4.8	Asynchronous counters- Binary and BCD counters- timing sequences and state diagrams. (Lecture 2)	**1 hour**
4.9	Synchronous counters- Binary Up- down counter, BCD counter	**1 hour**
Module 5: Shift registers, Arithmetic algorithms & PLD's		**(11 hours)**
5.1	**Shift Registers** - Serial In Serial Out, Serial In Parallel Out.	**1 hour**
5.2	Bidirectional Shift Register with Parallel load	**1 hour**

5.3	**Shift register counters** - Ring Counter, Johnson Counter- timing sequences and state diagrams	**1 hour**
5.4	**Arithmetic Algorithms:** Algorithm for addition and subtraction of binary numbers in Signed magnitude and 2's complement representations (Lecture 1)	**1 hour**
5.5	Algorithm for addition and subtraction of binary numbers in Signed magnitude and 2's complement representations (Lecture 2)	**1 hour**
5.6	Algorithm for addition and subtraction of BCD numbers	**1 hour**
5.7	Representation of floating point numbers (IEEE Standard representations).	**1 hour**
5.8	Algorithms for floating point addition and subtraction	**1 hour**
5.9	**Programmable Logic devices** - ROM	**1 hour**
5.10	PLA, Implementation of simple circuits using PLA(Lecture 1)	**1 hour**
5.11	PLA, Implementation of simple circuits using PLA(Lecture 2)	**1 hour**

CST 205	OBJECT ORIENTED PROGRAMMING USING JAVA	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	1	0	4	2019

Preamble: The purpose of this course is to enable learners to solve problems by breaking it down to object level while designing software and to implement it using Java. This course covers Object Oriented Principles, Object Oriented Programming in Java, Inheritance, Exception handling, Event handling, multithreaded programming and working with window-based graphics. This course helps the learners to develop Desktop GUI Applications, Mobile applications, Enterprise Applications, Scientific Applications and Web based Applications.

Prerequisite: Topics covered under the course PROGRAMMING IN C (EST 102)

Course Outcomes: After the completion of the course the student will be able to

CO1	Write Java programs using the object oriented concepts - classes, objects, constructors, data hiding, inheritance and polymorphism (Cognitive Knowledge Level: **Apply**)
CO2	Utilise datatypes, operators, control statements, built in packages & interfaces, Input/ Output Streams and Files in Java to develop programs (Cognitive Knowledge Level: **Apply**)
CO3	Illustrate how robust programs can be written in Java using exception handling mechanism (Cognitive Knowledge Level: **Understand**)
CO4	Write application programs in Java using multithreading and database connectivity (Cognitive Knowledge Level: **Apply**)
CO5	Write Graphical User Interface based application programs by utilising event handling features and Swing in Java (Cognitive Knowledge Level: **Apply**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓	✓	✓								✓
CO3	✓	✓	✓	✓						✓		✓
CO4	✓	✓	✓	✓								✓
CO5	✓	✓	✓	✓								✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test1 (Marks %)	Test2 (Marks %)	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Tests : 25 marks

Continuous Assessment Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks

First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus.

There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly covered module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly covered module), each with 7 marks. Out of the 7 questions in Part B, a student should answer any 5.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

SYLLABUS

Object Oriented Programming Using Java

Module 1

Introduction:

Approaches to Software Design - Functional Oriented Design, Object Oriented Design, Case Study of Automated Fire Alarm System.

Object Modeling Using Unified Modeling Language (UML) – Basic Object Oriented concepts, UML diagrams, Use case model, Class diagram, Interaction diagram, Activity diagram, State chart diagram.

Introduction to Java **-** Java programming Environment and Runtime Environment, Development Platforms -Standard, Enterprise. Java Virtual Machine (JVM), Java compiler, Bytecode, Java applet, Java Buzzwords, Java program structure, Comments, Garbage Collection, Lexical Issues.

Module 2

Core Java Fundamentals:

Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Type Conversion and Casting, Variables, Arrays, Strings, Vector class.

Operators **-** Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence.

Control Statements - Selection Statements, Iteration Statements and Jump Statements.

Object Oriented Programming in Java - Class Fundamentals, Declaring Objects, Object Reference, Introduction to Methods, Constructors, ***this*** Keyword, Method Overloading, Using Objects as Parameters, Returning Objects, Recursion, Access Control, Static Members, Final Variables, Inner Classes, Command Line Arguments, Variable Length Arguments.

Inheritance - Super Class, Sub Class, The Keyword ***super***, protected Members, Calling Order of Constructors, Method Overriding, the Object class, Abstract Classes and Methods, using ***final*** with Inheritance.

Module 3

More features of Java:

Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages, Interfaces.

Exception Handling **-** Checked Exceptions, Unchecked Exceptions, ***try*** Block and ***catch*** Clause, Multiple ***catch*** Clauses, Nested ***try*** Statements, ***throw***, ***throws*** and ***finally***.

Input/Output - I/O Basics, Reading Console Input, Writing Console Output, PrintWriter Class, Object Streams and Serialization, Working with Files.

Module 4

Advanced features of Java:

Java Library - String Handling – String Constructors, String Length, Special String Operations - Character Extraction, String Comparison, Searching Strings, Modifying Strings, using valueOf(), Comparison of StringBuffer and String.

Collections framework - Collections overview, Collections Interfaces- Collection Interface, List Interface.

Collections Class – ArrayList class. Accessing a Collection via an Iterator.

Event handling - Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Model.

Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.

Module 5

Graphical User Interface and Database support of Java:

Swings fundamentals - Swing Key Features, Model View Controller (MVC), Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings –JFrame, JLabel, The Swing Buttons, JTextField.

Java DataBase Connectivity (JDBC) - JDBC overview, Creating and Executing Queries – create table, delete, insert, select.

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
2. Rajib Mall, Fundamentals of Software Engineering, 4th edition, PHI, 2014.
3. Paul Deitel, Harvey Deitel, Java How to Program, Early Objects 11th Edition, Pearson, 2018.

Reference Books:

1. Y. Daniel Liang, Introduction to Java Programming, 7/e, Pearson, 2013.
2. Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008.
3. Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.
4. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.
5. Sierra K., Head First Java, 2/e, O'Reilly, 2005.
6. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.

Sample Course Level Assessment Questions

Course Outcome1(CO1): For the following passage develop UML diagrams and then implement it as a Java program in accordance with your UML design.

Passage: College Office collects semester fee and college bus fee for each student. A clerk at the college office collects the fees from each student. The bus fee is calculated depending on the distance of the corresponding bus stop from the college. The semester fee varies depending upon the semester as well as branch of each student. Students are supposed to pay the fees in full. Economically backward students are eligible for 50% discount in semester fee. The consolidated fees receipt is issued to each student by the clerk, which contains the student name, admission number, semester and branch of student along with details of fees collected. Students can log in and view the details of fees remitted and dues if any. The system allows students and clerk level login to the system. Clerk is able to view reports of each class showing status of fees payment of each student.

Course Outcome 2(CO2): Write a Java program to evaluate a post fix expression containing two operands and a single operator using stack. Stack should be implemented as a separate entity so as to reflect OOP concepts.

Course Outcome 3(CO3): Write a program to demonstrate the start, run, sleep and join methods in Thread class.

Course Outcome 4(CO4): Write a GUI based program with separate buttons to add, delete and display student details i.e. name, student ID, current semester and branch of study based on student ID.

Course Outcome 5(CO5): Using Swing create a JFrame with a JLabel and two JButtons. Set the texts of JButtons as “Yes” and “No” respectively. Set the JLabel’s text to the text of the button currently being pressed. Initially the JLabel’s text is blank.

Model Question Paper

QP CODE: PAGES:3

Reg No:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST 205

Course Name: Object Oriented Programming using Java

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Briefly explain the portable, secure and robust features of Java.
2. Describe the concepts of object and class with a suitable Java program.
3. Explain the concept of method overriding with an example.
4. What is the use of the keyword ***final*** in Java?
5. Explain the concept of streams.
6. Explain any two applications of Serialization.
7. Distinguish the usage of "==" and ***equals()*** method when comparing String type?
8. What are Collections in Java? Explain any one Collection interface in Java.
9. Explain any two properties of Swing components in Java.
10. Explain JLabel component. With suitable examples explain any two of its constructors.

Part B

Answer any one question completely from each module

11.

(a) Describe in detail any three Object Oriented Programming principles. Illustrate with suitable examples. (9)

(b) What is Java Runtime Environment? What is the role of Java Virtual Machine in it? (5)

OR

12.

(a) Compare and contrast Java standard edition and Java enterprise edition. (5)

(b) Why is Java considered to be platform independent? What is the role of Bytecode in making Java platform independent? (9)

13.

(a) Explain in detail the primitive data types in Java. (8)

(b) Explain automatic type conversion in Java with an example. What are the two conditions required for it? (6)

OR

14.

(a) Using a suitable Java program explain the difference between ***private*** and ***public*** members in the context of inheritance. (8)

(b) Is it possible to use the keyword ***super*** within a static method? Give justification for your answer. (6)

15.

(a) Explain in detail about byte streams and character streams with suitable code samples. (6)

(b) Describe in detail about exception handling, ***try*** block and ***catch*** clause with the help of a suitable Java program. (8)

OR

16.

(a) Explain object streams in Java. Explain the role of Serializable interface with a suitable code sample. (8)

(b) Explain ***throw***, ***throws*** and ***finally*** constructs with the help of a Java program. (6)

17.

(a) Describe in detail the creation of a thread using the Runnable interface and the Thread class with suitable examples. (10)

(b) Explain List Interface. Mention any two exceptions thrown by its methods. (4)

OR

18.

(a) Explain in detail the Delegation Event model for event handling in Java. (7)

(b) Write a simple program by extending appropriate class to demonstrate the working of threads in java. (7)

19.

(a) Write a Java program to demonstrate the use of JLabel and JButton by adding them to JFrame. (7)

(b) Explain step-by-step procedure of using Java DataBase Connectivity in Java programs. (7)

OR

20.

(a) Explain the class hierarchy of Java Swing components. (7)

(b) Write a Java Program to create a student table and to add student details to it using JDBC. (7)

Teaching Plan		
Module 1 : Introduction		(8 hours)
1.1	Approaches to Software Design- Functional Oriented Design, Object-Oriented Design, Case Study of Automated Fire Alarm System.	1 hour
1.2	Object Modeling Using UML – Basic object oriented concepts	1 hour
1.3	Basic object oriented concepts	1 hour
1.4	UML diagrams, Use case model	1hour
1.5	Class diagram, Interaction diagram	1hour
1.6	Activity diagram, State chart diagram	1hour
1.7	Java programming Environment and Runtime Environment, Development Platforms -Standard, Enterprise. JVM, Java compiler, Bytecode	1hour
1.8	Java applet, Java Buzzwords, Java program structure, Comments, Garbage Collection, Lexical Issues	1hour
Module 2: Core Java Fundamentals		(11 hours)
2.1	Core Java Fundamentals**:** Primitive Data types, Integers, Floating Point Types, Characters, Boolean	1 hour
2.2	Literals, Type Conversion and Casting, Variables, Arrays, Strings, Vector class.	1 hour
2.3	Operators: Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence.	1 hour
2.4	Control Statements: Selection Statements, Iteration Statements and Jump Statements.	1 hour
2.5	Object Oriented Programming in Java**:** Class Fundamentals, Declaring Objects, Object Reference, Introduction to Methods	1 hour
2.6	Constructors, ***this*** Keyword, Method Overloading, Using Objects as Parameters	1 hour
2.7	Returning Objects, Recursion, Access Control, static Members	1 hour

2.8	Final Variables, Inner Classes, Command-Line Arguments, Variable Length Arguments	1 hour
2.9	Inheritance : Super class, Sub class, the keywords ***super***, ***protected*** Members,	1 hour
2.10	Calling Order of Constructors, Method Overriding, the Object class,	1 hour
2.11	Abstract Classes and Methods, Using ***final*** with Inheritance	1 hour
Module 3: More features of Java		(8 hours)
3.1	Packages and Interfaces: Defining Package, CLASSPATH, Access Protection, Importing Packages	1 hour
3.2	Interfaces	1 hour
3.3	Input / Output: I/O Basics, Reading Console Input, Writing Console Output, PrintWriter Class	1 hour
3.4	Object Streams and Serialization	1 hour
3.5	Working with Files	1 hour
3.6	Exception Handling**:** Checked Exceptions, Unchecked Exceptions, ***try*** Block and ***catch*** Clause	1 hour
3.7	Multiple ***catch*** Clauses, Nested ***try*** Statements	1 hour
3.8	***throw***, ***throws*** and ***finally***	1 hour
Module 4:Advanced features of Java		(10 hours)
4.1	Java Library: String Handling – String Constructors, String Length, Special String Operations	1hour
4.2	Character Extraction, String Comparison, Searching Strings, Modifying Strings Using valueOf( ), Comparison of String Buffer and String.	1hour
4.3	Collections framework – Collections overview, Collections Interfaces-Collection Interface	1hour
4.4	List Interface, Collections Class – ArrayList Class	1hour
4.5	Accessing Collections via an Iterator.	1hour
4.6	Event handling**:** Event Handling Mechanisms, Delegation Event Model	1hour
4.7	Delegation Event Model, Event Classes	1hour

4.8	Sources of Events, Event Listener Interfaces, Using the Delegation Model	1hour
4.9	Multithreaded Programming: The Java Thread Model, The Main Thread, Creating Thread	1hour
4.10	Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.	1hour
Module 5: Graphical User Interface and Database support of Java		(8 hours)
5.1	Swings fundamentals, Swing Key Features	1hour
5.2	MVC, Swing Controls, Components and Containers	1hour
5.3	Swing Packages, Event Handling in Swings.	1 hour
5.4	Swing Layout Managers	1hour
5.5	Exploring Swings –JFrame, JLabel, The Swing Buttons, JTextField.	1 hour
5.6	JDBC overview, Creating and Executing Queries – create table, delete, insert, select (Basics only, DBMS course is not a prerequisite).	1hour
5.7	Creating and Executing Queries – create table, delete, insert, select.	1 hour
5.8	Creating and Executing Queries – create table, delete, insert, select.	1 hour

CSL201	DATA STRUCTURES LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2019

Preamble: The aim of the Course is to give hands-on experience for Learners on creating and using different Data Structures. Data Structures are used to process data and arrange data in different formats for many applications. The most commonly performed operations on data structures are traversing, searching, inserting, deleting and few special operations like merging and sorting.

Prerequisite: Topics covered under the course Programming in C (EST 102)

CO1	Write a time/space efficient program using arrays/linked lists/trees/graphs to provide necessary functionalities meeting a given set of user requirements **(Cognitive Knowledge Level: Analyse)**
CO2	Write a time/space efficient program to sort a list of records based on a given key in the record **(Cognitive Knowledge Level: Apply)**
CO3	Examine a given Data Structure to determine its space complexity and time complexities of operations on it **(Cognitive Knowledge Level: Apply)**
CO4	Design and implement an efficient data structure to represent given data **(Cognitive Knowledge Level: Apply)**
CO5	Write a time/space efficient program to convert an arithmetic expression from one notation to another **(Cognitive Knowledge Level: Apply)**
CO6	Write a program using linked lists to simulate Memory Allocation and Garbage Collection **(Cognitive Knowledge Level: Apply)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓		✓		✓		✓		✓
CO2	✓	✓	✓	✓				✓		✓		✓
CO3	✓	✓	✓	✓				✓		✓		✓
CO4	✓	✓	✓	✓				✓		✓		✓
CO5	✓	✓	✓					✓		✓		✓
CO6	✓	✓	✓					✓		✓		✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Test (Internal Exam)*Percentage*	End Semester Examination *Percentage*
Remember	20	20
Understand	20	20
Apply	60	60
Analyse		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**75**	**75**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance : 15 marks

Continuous Evaluation in Lab : 30 marks

Continuous Assessment Test : 15 marks

Viva-voce : 15 marks

Internal Examination Pattern: The marks will be distributed as Algorithm 30 marks, Program 20 marks, Output 20 marks and Viva 30 marks. Total 100 marks which will be converted out of 15 while calculating Internal Evaluation marks.

End Semester Examination Pattern: The marks will be distributed as Algorithm 30 marks, Program 20 marks, Output 20 marks and Viva 30 marks. Total 100 marks will be converted out of 75 for End Semester Examination.

Operating System to Use in Lab **:** Linux

Compiler/Software to Use in Lab **:** gcc

Programming Language to Use in Lab **:** Ansi C

Fair Lab Record:

All Students attending the Data Structures Lab should have a Fair Record. The fair record should be produced in the University Lab Examination. Every experiment conducted in the lab should be noted in the fair record. For every experiment in the fair record the right hand page should contain Experiment Heading, Experiment Number, Date of Experiment, Aim of Experiment, Data Structure used and the operations performed on them, Details of Experiment including algorithm and Result of Experiment. The left hand page should contain a print out of the code used for the experiment and sample output obtained for a set of input.

SYLLABUS

1. Implementation of Polynomials and Sparse matrices using arrays**
2. Implementation of Stack , Queues, Priority Queues, DEQUEUE and Circular Queues using arrays**
3. Application problems using stacks: Conversion of expression from one notation to another notation . **
4. Implementation of various linked list operations. **
5. Implementation of stack, queue and their applications using linked list.pression
6. Implementation of trees using linked list
7. Representation of polynomials using linked list, addition and multiplication of polynomials. **
8. Implementation of binary trees using linked lists and arrays- creations, insertion, deletion and traversal. **
9. Implementation of binary search trees – creation, insertion, deletion, search
10. Any application programs using trees
11. Implementation of sorting algorithms – bubble, insertion, selection, quick, merge sort

and heap sort.**

12. Implementation of searching algorithms – linear search, binary search.**

13. Representation of graphs and computing various parameters (in degree, out degree etc.) - adjacency list, adjacency matrix.

14. Implementation of BFS and DFS for each graph representations.**

15. Implementation of hash table using your own mapping functions and observe collisions and overflow resolving schemes.**

16. Simulation of first-fit, best-fit and worst-fit allocations.

17. Simulation of a basic memory allocator and garbage collector using doubly linked list.

** mandatory.

DATA STRUCTURES LAB - PRACTICE QUESTIONS

1. Write a program to read two polynomials and store them in an array. Calculate the sum of the two polynomials and display the first polynomial, second polynomial and the resultant polynomial.

2. C Write a program to enter two matrices in normal form . Write a function to convert two matrices to tuple form and display it. Also find the transpose of the two matrices represented in tuple form and display it. Find the sum of the two matrices in tuple form and display the sum in tuple form.

3. Write a program to enter two matrices in normal form . Write a function to convert two matrices to tuple form and display it. Also find the transpose of the two matrices represented in tuple form and display it. Find the sum of the two matrices in tuple form and display the sum in tuple form.

4. Implement a circular queue using arrays with the operations:
   4.1. Insert an element to the queue.
   4.2. Delete an elements from the queue.
   4.3. Display the contents of the queue after each operation.

5. Implement a Queue using arrays with the operations:

5.1. Insert elements to the Queue.
5.2. Delete elements from the Queue.
5.3. Display the contents of the Queue after each operation.

6. Implement a Stack using arrays with the operations:
   6.1. Pushing elements to the Stack.
   6.2. Popping elements from the Stack
   6.3. Display the contents of the Stack after each operation.

7. Implement a Priority Queue using arrays with the operations:
   7.1. Insert elements to the Priority Queue.
   7.2. Delete elements from the Priority Queue.
   7.3. Display the contents of the Priority Queue after each operation.

8. Implement a Double-Ended Queue (DEQUEUE) with the operations:
   8.1. Insert elements to the Front of the queue.
   8.2. Insert elements to the Rear of the queue
   8.3. Delete elements from the Front of the queue.
   8.4. Delete elements from the Rear of the queue.
   8.5. Display the queue after each operation.

9. Using stack convert an infix expression to a postfix expression and evaluate the postfix expression.

10. Write a program to convert an infix expression to a prefix expression using stacks.

11. Convert an infix expression to a postfix expression without using a stack

12. Write a menu driven program for performing the following operations on a Linked List:
   12.1. Display
   12.2. Insert at Beginning
   12.3. Insert at End
   12.4. Insert at a specified Position
   12.5. Delete from Beginning
   12.6. Delete from End
   12.7. Delete from a specified Position

13. Implement a stack using linked list with the operations:
   13.1. Push elements to the queue.
   13.2. Pop elements from the queue.
   13.3. Display the queue after each operation.

14. Implement a Queue using linked list with the operations:

14.1. Insert an elements to the queue.
14.2. Delete an elements from the queue.
14.3. Display the queue after each operation.

15. Write a program to reverse the content of queue using stack

16. Write a program to read two polynomials and store them using linked list. Calculate the sum of the two polynomials and display the first polynomial, second polynomial and the resultant polynomial.

17. Write a program to read two polynomials and store them using linked list. Find the product of two polynomials and store the result using linked list. Display the resultant polynomial.

18. Write a program for addition of polynomials containing two variables using linked list.

19. The details of students(number, name, total-mark) are to be stored in a linked list. Write functions for the following operations:
    19.1. Insert
    19.2. Delete
    19.3. Search
    19.4. Sort on the basis of number
    19.5. Display the resultant list after every operation

20. Create a Doubly Linked List from a string taking each character from the string. Check if the given string is palindrome in an efficient method.

21. Create a binary tree with the following operations
    21.1. Insert a new node
    21.2. Inorder traversal.
    21.3. Preorder traversal.
    21.4. Postorder traversal.
    21.5. Delete a node.

22. Write a program to create a binary search tree and find the number of leaf nodes

23. Create a binary search tree with the following operations:
    23.1. Insert a new node .
    23.2. Inorder traversal.
    23.3. Preorder traversal.
    23.4. Postorder traversal.
    23.5. Delete a node.

24. Write a program to sort a set of numbers using a binary tree.

25. Represent any given graph and
    25.1. Perform a depth first search .
    25.2. Perform a breadth first search

26. Create a text file containing the name, height, weight of the students in a class. Perform Quick sort and Merge sort on this data and store the resultant data in two separate files. Also write the time taken by the two sorting methods into the respective files.

Eg.	Sony Mathew	5.5	60
	Arun Sajeev	5.7	58
	Rajesh Kumar	6.1	70

27. Write a program to sort a set of numbers using Heap sort and find a particular number from the sorted set using Binary Search.

28. Implement a Hash table using Chaining method. Let the size of hash table be 10 so that the index varies from 0 to 9.

29. Implement a Hash table that uses Linear Probing for collision resolution

CSL 203	OBJECT ORIENTED PROGRAMMING LAB (IN JAVA)	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2019

Preamble: The aim of the course is to provide hands-on experience to the learners on various object oriented concepts in Java Programming. This course helps the learners to enhance the capability to design and implement various Java applications for real world problems.

Prerequisite: Topics covered under the course Programming in C (EST 102)

Course Outcomes:

At the end of the course, the student should be able to

CO1	Implement the Object Oriented concepts - constructors, inheritance, method overloading & overriding and polymorphism in Java (Cognitive Knowledge Level: **Apply**)
CO2	Implement programs in Java which use datatypes, operators, control statements, built in packages & interfaces, Input/Output streams and Files (Cognitive Knowledge Level: **Apply**)
CO3	Implement robust application programs in Java using exception handling (Cognitive Knowledge Level: **Apply**)
CO4	Implement application programs in Java using multithreading and database connectivity (Cognitive Knowledge Level: **Apply**)
CO5	Implement Graphical User Interface based application programs by utilizing event handling features and Swing in Java (Cognitive Knowledge Level: **Apply**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	☑	☑	☑	☑	☑			☑		☑		☑
CO2	☑	☑	☑	☑	☑			☑		☑		☑
CO3	☑	☑	☑	☑	☑			☑		☑		☑
CO4	☑	☑	☑	☑	☑			☑		☑		☑
CO5	☑	☑	☑	☑	☑			☑		☑		☑

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Test - Internal Exam (Percentage)	End Semester Examination (Percentage)
Remember	20	20
Understand	20	20
Apply	60	60
Analyse		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**75**	**75**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance	: 15 marks
Continuous Evaluation in Lab	: 30 marks
Continuous Assessment Test	: 15 marks
Viva-voce	: 15 marks

Internal Examination Pattern: The marks will be distributed as Algorithm 30 marks, Program 20 marks, Output 20 marks and Viva 30 marks. Total 100 marks which will be converted out of 15 while calculating Internal Evaluation marks.

End Semester Examination Pattern: The marks will be distributed as Algorithm 30 marks, Program 20 marks, Output 20 marks and Viva 30 marks. Total 100 marks will be converted out of 75 for End Semester Examination.

Operating System to Use in Lab **:** Linux

Compiler/Software to Use in Lab **:** gcc, javac, jdk, jre, Eclipse, NetBeans, MySQL / PostgreSQL.

Programming Language to Use in Lab **:** Java

Fair Lab Record:
All Students attending the Object Oriented Programming Lab (in Java) should have a Fair Record. The fair record should be produced in the University Lab Examination. Every experiment conducted in the lab should be noted in the fair record. For every experiment in the fair record the right hand page should contain Experiment Heading, Experiment Number, Date of Experiment, Aim of Experiment, Operations Performed, Details of Experiment including algorithm and Result of Experiment. The left hand page should contain a print out of the code used for the experiment and sample output obtained for a set of input.

SYLLABUS

The syllabus contains six sessions (A, B, C, D, E, F). Each session consists of three concrete Java exercises, out of which at least two questions are mandatory.

(A) Basic programs using datatypes, operators, and control statements in Java.

1) Write a Java program that checks whether a given string is a palindrome or not.
   Ex: MALAYALAM is palindrome.
2) Write a Java Program to find the frequency of a given character in a string. **
3) Write a Java program to multiply two given matrices. **

(B) Object Oriented Programming Concepts: Problem on the use of constructors, inheritance, method overloading & overriding, polymorphism and garbage collection:

4) Write a Java program which creates a class named 'Employee' having the following members: Name, Age, Phone number, Address, Salary. It also has a method named 'print-Salary( )' which prints the salary of the Employee. Two classes 'Officer' and 'Manager' inherits the 'Employee' class. The 'Officer' and 'Manager' classes have data members 'specialization' and 'department' respectively. Now, assign name, age, phone number, address and salary to an officer and a manager by making an object of both of these classes and print the same. (Exercise to understand inheritance). **
5) Write a java program to create an abstract class named Shape that contains an empty method named numberOfSides( ). Provide three classes named Rectangle, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method numberOfSides( ) that shows the number of sides in the given geometrical structures. (Exercise to understand polymorphism). **
6) Write a Java program to demonstrate the use of garbage collector.

(C) Handling different types of files as well as input and output management methods:

7) Write a file handling program in Java with reader/writer.
8) Write a Java program that read from a file and write to file by handling all file related exceptions. **
9) Write a Java program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util). **

(D) Exception handling and multi-threading applications:

10) Write a Java program that shows the usage of try, catch, throws and finally. **
11) Write a Java program that implements a multi-threaded program which has three threads. First thread generates a random integer every 1 second. If the value is even, second thread computes the square of the number and prints. If the value is odd the third thread will print the value of cube of the number.
12) Write a Java program that shows thread synchronization. **

(E) Graphics Programming:

13) Write a Java program that works as a simple calculator. Arrange Buttons for digits and the + - * % operations properly. Add a text field to display the result. Handle any possible exceptions like divide by zero. Use Java Swing. **
14) Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time. No light is on when the program starts. **
15) Write a Java program to display all records from a table using Java Database Connectivity (JDBC).

(F) Standard Searching and Sorting Algorithms using data structures and algorithms learned from course Data Structures (**CST 201**):

16) Write a Java program for the following: **
    1) Create a doubly linked list of elements.
    2) Delete a given element from the above list.
    3) Display the contents of the list after deletion.
17) Write a Java program that implements Quick sort algorithm for sorting a list of names in ascending order. **
18) Write a Java program that implements the binary search algorithm.

** Mandatory

PRACTICE QUESTIONS

1) Write a Java program to reverse an given string.
2) Write a Java program to display the transpose of a given matrix.
3) Write a Java program to find the second smallest element in an array.
4) Write a Java program to check whether a given number is prime or not.
5) Write a Java program to calculate the area of different shapes namely circle, rectangle, and triangle using the concept of method overloading.
6) Write two Java classes Employee and Engineer. Engineer should inherit from Employee class. Employee class to have two methods display() and calcSalary(). Write a program to display the engineer salary and to display from Employee class using a single object instantiation (i.e., only one object creation is allowed).
   - display() only prints the name of the class and does not return any value. Ex. " Name of class is Employee."
   - calcSalary() in Employee displays "Salary of employee is 10000" and calcSalary() in Engineer displays "Salary of employee is 20000."
7) Write a Java program to illustrate Interface inheritance.
8) Write a Java program that shows how to create a user-defined exception.
9) Write a Java program to create two threads: One for displaying all odd number between 1 and 100 and second thread for displaying all even numbers between 1 and 100.
10) Write a Java program that shows thread priorities.
11) Write a Java program that reads a file and displays the file on the screen, with a line number before each line.
12) Write a Java program that displays the number of characters, lines and words in a text file.
13) Write a Java program for handling mouse events.
14) Write a Java program for handling key events using Adapter classes (general).
15) Write a Java program that allows the user to draw lines, rectangles and ovals.
16) Write a Java Swing program to print a wave form on the output screen.
17) Write a program to accept rollno, name, CGPA of "n" students and store the data to a database using JDBC connectivity. Display the list of students having CGPA greater than 7. (Use MySQL /PostgreSQL).
18) Write a Java program to implement Heap sort algorithm using array.

SEMESTER IV

MAT 266	MATHEMATICAL FOUNDATIONS FOR SECURITY SYSTEMS	Category	L	T	P	Credit	Year of Introduction
		BSC	3	1	0	4	2021

Preamble: This course helps the learners to understand the concepts of algebraic structures, number theory and random variables. The topics covered include rings, finite field, properties of numbers, primality test, factorization, vector space and discrete random variables. These concepts will help them to develop security model and analyse them before being used in many commercial, industrial as well as web application.

Prerequisite: A sound knowledge in elementary algebraic and probability concepts.

Course Outcomes: After the completion of the course the student will be able to

CO1	Illustrate the basic concepts of various algebraic structures like rings, finite fields and construction of Galois fields.**(Cognitive Knowledge Level: Apply)**
CO2	Make use of concepts of vector space and its operations.**(Cognitive Knowledge Level: Apply)**
CO3	Identify and apply the properties of integers including divisibility, congruence, primality testing, prime factorization, modulo operations.**(Cognitive Knowledge Level: Apply)**
CO4	Recognize the concepts and properties of discrete random variables and use them to model and analyse random phenomena.**(Cognitive Knowledge Level: Apply)**

Mapping of course outcomes with program outcomes

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓	✓	✓								✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓	✓	✓								✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Lifelong learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test 1 (%)	Test 2 (%)	
Remember	**20**	**20**	**20**
Understand	**40**	**40**	**40**
Apply	**40**	**40**	**40**
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**50**	**100**	**3**

Continuous Internal Evaluation Pattern:

Attendance	**10 marks**
Continuous Assessment Tests(Average of Internal Tests1& 2)	**25 marks**
Continuous Assessment Assignment	**15 marks**

Internal Examination Pattern

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 full questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module – 1 (Algebraic Structures)

Rings – Definition, Rings of Polynomial. Quotient Rings. Fields – Finite field, Galois Field Construction – Illustration. Applications in LFSR, Properties of Galois fields. Subfields of Galois Fields. (All theorems without proofs.).

Module– 2(Linear Algebra)

Irreducible and Primitive Polynomials. Conjugate Elements and Minimal Polynomials.
Vector space – Linear combination of the vectors, Spanning set for vector space, Row space, column space, linearly dependent and independent vectors, Basis, Vector subspace, Inner product, Orthogonality, dual space. (All theorems without proofs.)

Module - 3 (Number Theory I)

Divisibility, Greatest Common Divisor, Euclidean Algorithm, The Extended Euclidean Algorithm. Congruence, Residue Classes. Primes, Cardinality of Primes, Checking for Primeness, Euler's phi function, Fermat's Little Theorem, Euler's Theorem, Generating Primes.

Module - 4 (Number Theory II)

Primality Testing – Fermat's Test, Divisibility Test, Miller – Rabin Test, Combination of Divisibility Test and Miller – Rabin Test. Factorization – Fundamental Theorem of Arithmetic, Fermat method, Pollard p-1 method, Pollard rho method. The Chinese Remainder Theorem. Quadratic Congruence - Quadratic Congruence Modulo a Prime, Quadratic Congruence Modulo a Composite. Order of an element, Primitive Roots.

Module - 5 (Probability Theory)

Discrete random variable, Probability distributions, Expected value, Variance, Sum and Product of Random Variable, Independent Random variables. Binomial distribution, Mean and Variance. Markov's inequality, Chebysheff's inequality. Law of Large Numbers. Entropy – Entropy of a sample space, Joint entropy and conditional entropy.

Text Books

1. Todd K. Moon, 'Error Correction Coding, Mathematical Methods and Algorithms', Second Edition, John Wiley & Sons, 2021.
2. Behrouz A. Forouzan, 'Cryptography and Network Security', McGraw-Hill.
3. Paul Garrett, 'The Mathematics of Coding Theory', Prentice-Hall. Inc., 2004.

ReferenceBooks

1. Thomas Koshy, 'Elementary Number Theory with Applications', Second Edition, Elsevier Inc., 2007.
2. David c. Lay, Linear Algebra and its Applications, 3rd edition.
3. Stephen Andrilli and David Hecker, 'Elementary Linear Algebra', Fifth edition, Elsevier Inc, 2016.
4. Fraleigh J. B., 'A first course in abstract algebra', Narosa, 1990.
5. Sheldon M. Ross, "Introduction to Probability Models", Academic Press, 2003
6. Niven, H. S. Zuckerman and H. L. Montgomery, An introduction to the theory of numbers, John Wiley and Sons, 2004.
7. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8th edition, Cengage, 2012.

Course Level Assessment Questions

Course Outcome1 (CO1):

1. Check whether the set of 2 x 2 matrices under usual definitions of addition and multiplication form a ring?
2. Is every field a ring? Does the converse hold? Justify your answer.
3. Check whether 242 a Galois field.
4. Illustrate the subfields of $GF(2^{24})$.

Course Outcome 2(CO2):

1. Does $(x^3 + x + 1)$divides$(x^7 + 1)$ in $GF\ (2)$?
2. If $f(x) \epsilon\ GF(q)[x]$ is irreducible, then is it possible for all the roots of f(x) to have the same order?
3. Determine the minimal polynomial for each conjugacy class in GF(8) with respect to GF(2).
4. Is it true that if x, y and z are linearly independent vectors over GF(q) then so also are x + y, y + z and z + x?

Course Outcome 3(CO3):

1. Using the Euclidean algorithm, find the greatest common divisor of 88 and 220.
2. Find the result of 6^{10} mod 11.
3. Specify the formula for a Fermat number? Is F_5 a prime?
4. The number 4033 is a composite (33 x 109). Does it pass the Miller – Rabin test?
5. Use The Pollard p – 1 method to find a factor of 57247159 with the bound B = 8.
6. Find an integer that has a remainder of 3 when divided by 7 and 13, but is divisible by 12.
7. For the group $G = \langle Z_{19}^*\ ,\ \times \rangle$: find the order of each element in the group. Also find the primitive roots in the group.
8. Implement primality test (Programming Assignment)

Course Outcome 4 (CO4):

1. Let X denote the number that show up when an unfair die is tossed. Faces 1 to 5 of the die are equally likely, while face 6 is twice as likely as any other. Find the probability distribution, mean and variance of X.
2. An equipment consists of 5 components each of which may fail independently with probability 0.15. If the equipment is able to function properly when at least three of the components are operational, what is the probability that it functions properly?
3. Compute the expected value and variance of the random variable which tells the sum of the result of the roll of two fair dice.
4. Determine the entropy of the random variable which counts the sum of three dice.

Model Question Paper

QP CODE:

Reg No: _____

Name: _____ **PAGES: 4**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MAT266

Course Name: MATHEMATICAL FOUNDATIONS FOR SECURITY SYSTEMS

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer All Questions. Each Question Carries 3 Marks

1. Define a ring with a suitable example.
2. Is$GF(12)$ a Galois field? Justify.
3. Show that $x^5 + x^3 + 1$ is irreducible over GF (2).
4. Using an example show that the intersection oftwo subspaces is also a subspace of a vector space.
5. Find the greatest common divisor of 25 and 60.
6. Define Mersenne primes.Are all Mersenne primesprimes? Justify.
7. Find the order of all elements in $G = \langle Z_{10}^*, \times \rangle$.
8. Test whether the number 561 pass the Miller – Rabin Test?
9. Let X and Y be two independent random variables with $Var(2X - Y) = 6$ and $Var(X + 2Y) = 9$. Find Var (X) and Var (Y).

10. Find the probability of exactly 3 heads out of 10 flips of a fair coin?

(10x3=30)

Part B

(Answer any one question from each module. Each question carries 14 Marks)

11. (a) Construct the ring $R_4 = GF(2)[x]/(x^3+1)$. Is R_4a field? **(7)**

    (b) In $GF(2^4)$, find the product of the Galois field numbers $1+\alpha+\alpha^3$ and $\alpha+\alpha^2$. **(7)**

OR

12. (a) Prove that the characteristic of a field must be either 0 or a prime number. **(7)**

    (b) The field GF (4) is a subfield of GF (256). Let α be primitive in GF (256). Find an element in GF(4) $\subset$ GF(256). **(7)**

13. (a) Determine whether each of the following polynomials in $GF(2)[x]$ is irreducible. If irreducible, determine if it is also primitive.
    (i) x^2+1 (ii) x^3+x+1. **(7)**

    (b) Find all conjugacy classes in $GF(2^4)$ with respect to GF (4). **(7)**

OR

14. (a) Check that $V = \left\{\binom{x}{y} : x, y \epsilon \mathbb{R}\right\}$ with the usual addition and scalar multiplication is a vector space. **(7)**

    (b) Find a basis for the dual space to the vector space spanned by $\{(1,1,1,0,0),(0,1,1,1,0),(0,0,1,1,1)\}$. **(7)**

15. (a) Given a = 161 and b = 28, find gcd (a, b) using Extended Euclidean Algorithm and also find the integers s and t such that $sa+tb = \gcd(a,b)$ **(7)**

    (b) Find the results of the following using Fermat's little theorem:
    (i) 5^{-1} mod 13 (ii) 5^{15} mod 13. **(7)**

OR

16. (a) Define Euler's totient function. What are the values of $\varphi(13), \varphi(240)$. Determine the number of elements in Z_{14}^*? **(7)**

(b) Find the results of the following using Euler's theorem: **(7)**
(i) 20^{62} mod 77 (ii) 71^{-1} mod 100.

17. (a) Use any primality test to determine whether any of the following integers are primes: 271, 3149, 9673. **(7)**

(b) Assume that there is a computer that can perform 2^{30} (almost 1 billion) bit operations per second. What is the approximation time required to factor an integer of size (i) 60 decimal digits? (ii) 100 decimal digits? (using Pollard rho method). **(7)**

OR

18. (a) State Chinese Remainder Theorem. Find the solution to the simultaneous equations: **(7)**

$$x \equiv 2 \, mod \, 3$$
$$x \equiv 3 \, mod \, 5$$
$$x \equiv 2 \, mod \, 7.$$

(b) Solve the following quadratic equations: **(7)**
(i) $x^2 \equiv 3(mod\ 23)$(ii) $x^2 \equiv 2(mod\ 11)$ (iii) $x^2 \equiv 7(mod\ 19)$.

19. (a) The probability mass function of a discrete random variable is $p(x) = kx, x = 1,2,3$, where 'k' is a positive constant. Find **(7)**
(i) the value of 'k' (ii) $P(X \leq 2)$ (iii) E[X] and (iv) Var (1 – X).

(b) Find the mean and variance of a binomial distribution. **(7)**

OR

20. (a) With a coin that has probability only $\frac{1}{10}$ of coming up heads, show that the probability is less than $\frac{1}{900}$ that in 10,000 flips the number of heads will be **(7)**

less than 2000.

(b) Determine the entropy of the random variable which counts the number of heads in flipping three fair coins. **(7)**

Teaching Plan

No	Contents	No. of Lecture Hours (45 hrs)
	Module-1(Algebraic Structures) (9 hours) **(Text 1: Relevant topics from sections 4.3, 4.4, 5.4, 5.5, 5.7)** **(Section 5.4.1 is excluded)**	
1.1	Rings – Definition.	1 hour
1.2	Rings of Polynomial	1 hour
1.3	Quotient Rings.	1 hour
1.4	Fields – Finite field	1 hour
1.5	Galois Field Construction	1 hour
1.6	Galois Field Construction – Illustration	1 hour
1.7	Applications in LFSR.	1 hour
1.8	Properties of Galois Fields.	1 hour
1.9	Subfields of Galois Fields.	1 hour
	Module-2(Linear Algebra)(11 hours) **(Text 1: Relevant topics from sections 5.8, 5.9, 2.4)**	
2.1	Irreducible Polynomials.	1 hour
2.2	Primitive Polynomials.	1 hour
2.3	Conjugate Elements.	1 hour
2.4	Minimal Polynomials.	1 hour
2.5	Vector space.	1 hour

2.6	Linear combination of the vectors, Spanning set for vector space.	1 hour
2.7	Row space, Column space.	1 hour
2.8	Linearly dependent and independent vectors, Basis.	1 hour
2.9	Vector subspace.	1 hour
2.10	Inner product.	1 hour
2.11	Orthogonality, dual space	1 hour
Module-3(Number Theory I) (9 hours) (Text 2: Relevant topics from sections 2.1, 2.2, 9.1)		
3.1	Divisibility, Greatest Common Divisor.	1 hour
3.2	Euclidean Algorithm.	1 hour
3.3	The Extended Euclidean Algorithm.	1 hour
3.4	Congruence, Residue Classes.	1 hour
3.5	Primes, Cardinality of Primes, Checking for Primeness.	1 hour
3.6	Euler's phi function	1 hour
3.7	Fermat's Little Theorem.	1 hour
3.8	Euler's Theorem.	1 hour
3.9	Generating Primes.	1 hour
Module-4 (Number Theory II) (8 hours) (Text 2: Relevant topics from sections 9.2, 9.3, 9.4, 9.5, 9.6)		
4.1	Fundamental Theorem of Arithmetic, Primality Testing – Fermat's Test, Divisibility Test.	1 hour
4.2	Miller – Rabin Test.	1 hour
4.3	Combination of Divisibility Test and Miller – RabinTest.	1 hour
4.4	Fermat method.	1 hour
4.5	Pollard p-1 method, Pollard rho method.	1 hour
4.6	The Chinese Remainder Theorem.	1 hour
4.7	Quadratic Congruence Modulo a Prime, Quadratic Congruence Modulo a	1 hour

	Composite.	
4.8	Order of an element, Primitive Roots.	1 hour
Module-5(Probability Theory)(8 hours) (Text 3: Relevant topics from sections 1.5, 1.6, 1.7, 2.2)		
5.1	Discrete random variable, Probability distributions, Expectation, Variance.	1 hour
5.2	Independent Random variables, Sum and Product of random Variables.	1 hour
5.3	Binomial distribution, Mean and Variance.	1 hour
5.4	Binomial distribution – Problems.	1 hour
5.5	Markov's inequality, Chebysheff's inequality.	1 hour
5.6	Law of Large Numbers.	1 hour
5.7	Entropy of a sample space, Joint entropy and conditional entropy.	1 hour
5.8	Entropy of a sample space – Problems.	1 hour

CST202	COMPUTER ORGANISATION AND ARCHITECTURE	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	1	0	4	2019

Preamble:

The course is prepared with the view of enabling the learners capable of understanding the fundamental architecture of a digital computer. Study of Computer Organization and Architecture is essential to understand the hardware behind the code and its execution at physical level by interacting with existing memory and I/O structure. It helps the learners to understand the fundamentals about computer system design so that they can extend the features of computer organization to detect and solve problems occurring in computer architecture.

Prerequisite : Topics covered under the course Logic System Design (CST 203)

Course Outcomes: After the completion of the course the student will be able to

CO#	CO
CO1	Recognize and express the relevance of basic components, I/O organization and pipelining schemes in a digital computer **(Cognitive knowledge: Understand)**
CO2	Explain the types of memory systems and mapping functions used in memory systems **(Cognitive Knowledge Level: Understand)**
CO3	Demonstrate the control signals required for the execution of a given instruction **(Cognitive Knowledge Level: Apply))**
CO4	Illustrate the design of Arithmetic Logic Unit and explain the usage of registers in it (**Cognitive Knowledge Level: Apply**)
CO5	Explain the implementation aspects of arithmetic algorithms in a digital computer **(Cognitive Knowledge Level:Apply)**
CO6	Develop the control logic for a given arithmetic problem (**Cognitive Knowledge Level: Apply**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓	✓	✓						✓		✓
CO3	✓	✓	✓	✓						✓		✓
CO4	✓	✓	✓	✓						✓		✓
CO5	✓	✓	✓							✓		✓
CO6	✓	✓	✓	✓								✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test1 (%)	Test2 (%)	
Remember	20	20	30
Understand	40	40	30
Apply	40	40	40
Analyze			

Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**50**	**100**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Tests : 25 marks

Continuous Assessment Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks

First Internal Examination shall be preferably conducted after completing the first half of the syllabus and the Second Internal Examination shall be preferably conducted after completing remaining part of the syllabus.

There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly covered module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly covered module), each with 7 marks. Out of the 7 questions in Part B, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module 1

Basic Structure of computers – functional units - basic operational concepts - bus structures. Memory locations and addresses - memory operations,Instructions and instruction sequencing , addressing modes.

Basic processing unit – fundamental concepts – instruction cycle – execution of a complete instruction - single bus and multiple bus organization

Module 2

Register transfer logic: inter register transfer – arithmetic, logic and shift micro operations.

Processor logic design: - processor organization – Arithmetic logic unit - design of arithmetic circuit - design of logic circuit - Design of arithmetic logic unit - status register – design of shifter - processor unit – design of accumulator.

Module 3

Arithmetic algorithms: Algorithms for multiplication and division (restoring method) of binary numbers. Array multiplier , Booth's multiplication algorithm.

Pipelining: Basic principles**,** classification of pipeline processors, instruction and arithmetic pipelines (Design examples not required), hazard detection and resolution.

Module 4

Control Logic Design: Control organization – Hard_wired control-microprogram control – control of processor unit - Microprogram sequencer,micro programmed CPU organization - horizontal and vertical micro instructions.

Module 5

I/O organization: accessing of I/O devices – interrupts, interrupt hardware -Direct memory access.

Memory system: basic concepts – semiconductor RAMs. memory system considerations – ROMs, Content addressable memory, cache memories - mapping functions.

Text Books

1. Hamacher C., Z. Vranesic and S. Zaky, Computer Organization ,5/e, McGraw Hill, 2011
2. Mano M. M., Digital Logic & Computer Design, PHI, 2004
3. KaiHwang, Faye Alye Briggs, Computer architecture and parallel processing McGraw-Hill, 1984

Reference Books

1. Mano M. M., Digital Logic & Computer Design, 3/e, Pearson Education, 2013.
2. Patterson D.A. and J. L. Hennessy, Computer Organization and Design, 5/e, Morgan Kaufmann Publishers, 2013.
3. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson, 9/e, 2013.
4. Chaudhuri P., Computer Organization and Design, 2/e, Prentice Hall, 2008.
5. Rajaraman V. and T. Radhakrishnan, Computer Organization and Architecture, Prentice Hall, 2011

Sample Course Level Assessment Questions

Course Outcome1(CO1): Which are the registers involved in a memory access operation and how are they involved in it?

Course Outcome 2(CO2): Explain the steps taken by the system to handle a write miss condition inside the cache memory.

Course Outcome 3(CO3): Generate the sequence of control signals required for the execution of the instruction MOV [R1],R2 in a threebus organization.

Course Outcome 4(CO4): Design a 4-bit combinational logic shifter with 2 control signals H0 and H1 that perform the following operations :

H1	H0	Operation
0	0	Transfer 1's to all output line
0	1	No shift operation
1	0	Shift left
1	1	Shift right

Course Outcome 5(CO5): Explain the restoring algorithm for binary division. Also trace the algorithm to divide $(1001)_2$ by $(11)_2$

Course Outcome 6(CO6): Design a software control logic based on microprogramed control to perform the addition of 2 signed numbers represented in sign magnitude form.

Model Question Paper

QP CODE: PAGES:2

Reg No:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST 202

Course Name: Computer organisation and architecture

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Give the significance of instruction cycle.
2. Distinguish between big endian and little endian notations. Also give the significance of these notations.
3. Compare I/O mapped I/O and memory mapped I/O.
4. Give the importance of interrupts in I/O interconnection.
5. Justify the significance of status register.
6. How does the arithmetic circuitry perform logical operations in an ALU.
7. Illustrate divide overflow with an example.
8. Write notes on arithmetic pipeline.
9. Briefly explain the role of micro program sequence.
10. Differentiate between horizontal and vertical micro instructions.

Part B

Answer any one Question from each module. Each question carries 14 Marks

11.

11.(a) What is the significance of addressing modes in computer architecture.

(4)

11.(b) Write the control sequence for the instruction DIV R1,[R2] in a three bus structure.

(10)

OR

12. Explain the concept of a single bus organization with help of a diagram. Write the control sequence for the instruction ADD [R1],[R2].

(14)

13. Explain various register transfer logics.

(14)

OR

14.

14.(a) Design a 4 bit combinational logic shifter with 2 control signals H1 and H2 that perform the following operations (bit values given in parenthesis are the values of control variable H1 and H2 respectively.) : Transfer of 0's to S (00), shift right (01), shift left (10), no shift (11).

(5)

14.(b) Design an ALU unit which will perform arithmetic and logic operation with a given binary adder.

(9)

15.

15.(a) Give the logic used behind Booth's multiplication algorithm.

(4)

15.(b) Identify the appropriate algorithm available inside the system to perform the multiplication between -14 and -9. Also trace the algorithm for the above input.

(10)

OR

16.

16.(a) List and explain the different pipeline hazards and their possible solutions

(10)

16.(b) Design a combinational circuit for 3x2 multiplication. (4)

17. Design a hardwared control unit used to perform addition/subtraction of 2 numbers represented in sign magnitude form. (14)

OR

18. Give the structure of the micro program sequencer and its role in sequencing the micro instructions. (14)

19.

19.(a) Explain the different ways in which interrupt priority schemes can be implemented (10)

19.(b) Give the structure of SRAM cell. (4)

OR

20.

20.(a) Explain the various mapping functions available in cache memory. (9)

20.(b) Briefly explain content addressable memory. (5)

TEACHING PLAN		
No	**Contents**	**No of Lecture Hrs**
Module 1 : (Basic Structure of computers) (9 hours)		
1.1	Functional units,basic operational concepts,bus structures (introduction)	1
1.2	Memory locations and addresses , memory operations	1
1.3	Instructions and instruction sequencing	1
1.4	Addressing modes	1
1.5	Fundamental concepts of instruction execution, instruction cycle	1
1.6	Execution of a complete instruction - single bus organization (Lecture 1)	1
1.7	Execution of a complete instruction - single bus organization (Lecture 2)	1
1.8	Execution of a complete instruction - multiple bus organization (Lecture 1)	1
1.9	Execution of a complete instruction - multiple bus organization (Lecture 2)	1
Module 2 :(Register transfer logic and Processor logic design) (10 hours)		
2.1	Inter register transfer – arithmetic micro operations	1
2.2	Inter register transfer – logic and shift micro operations	1
2.3	Processor organization	1
2.4	Design of arithmetic circuit	1
2.5	Design of logic circuit	1
2.6	Design of arithmetic logic unit	1
2.7	Design of status register	1
2.8	Design of shifter - processor unit	1

2.9	Design of accumulator (Lecture 1)	1
2.10	Design of accumulator (Lecture 2)	1
Module 3 : (Arithmetic algorithms and Pipelining) (9 hours)		
3.1	Algorithm for multiplication of binary numbers	1
3.2	Algorithm for division (restoring method) of binary numbers	1
3.3	Array multiplier	1
3.4	Booth's multiplication algorithm	1
3.5	Pipelining: Basic principles	1
3.6	Classification of pipeline processors (Lecture 1)	1
3.7	Classification of pipeline processors (Lecture 2)	1
3.8	Instruction and arithmetic pipelines (Design examples not required)	1
3.9	Hazard detection and resolution	1
Module 4 :(Control Logic Design) (9 hours)		
4.1	Control organization –design of hardwired control logic (Lecture 1)	1
4.2	Control organization –design of hardwired control logic (Lecture 2)	1
4.3	Control organization –design of hardwired control logic (Lecture 3)	1
4.4	Design of microprogram control logic–control of processor unit (Lecture1)	1
4.5	Design of microprogram control logic–control of processor unit (Lecture2)	1
4.6	Design of microprogram control logic–control of processor unit (Lecture3)	1
4.7	Microprogram sequencer	1
4.8	Micro programmed CPU organization	1
4.9	Microinstructions –horizontal and vertical micro instructions	1
Module 5 : (Basic processing units, I/O and memory) (8 hours)		
5.1	Accessing of I/O devices –interrupts	1
5.2	Interrupt hardware	1

5.3	Direct memory access	1
5.4	Memory system: basic concepts –semiconductor RAMs	1
5.5	Memory system considerations – ROMs	1
5.6	Content addressable memory	1
5.7	Cache memories -mapping functions (Lecture 1)	1
5.8	Cache memories -mapping functions (Lecture 2)	1

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
KTU
Estd. 2014

CST 204	DATABASE MANAGEMENT SYSTEMS	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	1	0	4	2019

Preamble: This course provides a clear understanding of fundamental principles of Database Management Systems (DBMS) with special focus on relational databases to the learners. The topics covered in this course are basic concepts of DBMS, Entity Relationship (ER) model, Relational Database principles, Relational Algebra, Structured Query Language (SQL), Physical Data Organization, Normalization and Transaction Processing Concepts. The course also gives a glimpse of the alternative data management model, NoSQL. This course helps the learners to manage data efficiently by identifying suitable structures to maintain data assets of organizations and to develop applications that utilize database technologies.

Prerequisite: Topics covered under the course Data Structures (CST 201), Exposure to a High Level Language like C/python.

Course Outcomes: After the completion of the course the student will be able to

CO1	Summarize and exemplify fundamental nature and characteristics of database systems (**Cognitive Knowledge Level: Understand)**
CO2	Model real word scenarios given as informal descriptions, using Entity Relationship diagrams. **(Cognitive Knowledge Level: Apply)**
CO3	Model and design solutions for efficiently representing and querying data using relational model (**Cognitive Knowledge Level: Analyze**)
CO4	Demonstrate the features of indexing and hashing in database applications **(Cognitive Knowledge Level: Apply)**
CO5	Discuss and compare the aspects of Concurrency Control and Recovery in Database systems **(Cognitive Knowledge Level: Apply)**
CO6	Explain various types of NoSQL databases (**Cognitive Knowledge Level: Understand**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓	✓	✓	✓								✓
CO3	✓	✓	✓	✓								✓
CO4	✓	✓	✓							✓		✓
CO5	✓	✓	✓							✓		✓
CO6	✓	✓	✓		✓					✓		✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test1 (%)	Test2 (%)	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30

Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**50**	**100**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Tests : 25 marks

Continuous Assessment Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks

First Internal Examination shall be preferably conducted after completing the first half of the syllabus and the Second Internal Examination shall be preferably conducted after completing remaining part of the syllabus.

There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly covered module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly covered module), each with 7 marks. Out of the 7 questions in Part B, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module 1: Introduction & Entity Relationship (ER) Model

Concept & Overview of Database Management Systems (DBMS) - Characteristics of Database system, Database Users, structured, semi-structured and unstructured data. Data Models and Schema - Three Schema architecture. Database Languages, Database architectures and classification.

ER model - Basic concepts, entity set & attributes, notations, Relationships and constraints, cardinality, participation, notations, weak entities, relationships of degree 3.

Module 2: Relational Model

Structure of Relational Databases - Integrity Constraints, Synthesizing ER diagram to relational schema

Introduction to Relational Algebra - select, project, cartesian product operations, join - Equi-join, natural join. query examples, introduction to Structured Query Language (SQL), Data Definition Language (DDL), Table definitions and operations – CREATE, DROP, ALTER, INSERT, DELETE, UPDATE.

Module 3: SQL DML (Data Manipulation Language), Physical Data Organization

SQL DML (Data Manipulation Language) - SQL queries on single and multiple tables, Nested queries (correlated and non-correlated), Aggregation and grouping, Views, assertions, Triggers, SQL data types.

Physical Data Organization - Review of terms: physical and logical records, blocking factor, pinned and unpinned organization. Heap files, Indexing, Singe level indices, numerical examples, Multi-level-indices, numerical examples, B-Trees & B+-Trees (structure only, algorithms not required), Extendible Hashing, Indexing on multiple keys – grid files.

Module 4: Normalization

Different anomalies in designing a database, The idea of normalization, Functional dependency, Armstrong's Axioms (proofs not required), Closures and their computation, Equivalence of Functional Dependencies (FD), Minimal Cover (proofs not required). First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), Boyce Codd Normal Form (BCNF), Lossless join and dependency preserving decomposition, Algorithms for checking Lossless Join (LJ) and Dependency Preserving (DP) properties.

Module 5: Transactions, Concurrency and Recovery, Recent Topics

Transaction Processing Concepts - overview of concurrency control, Transaction Model, Significance of concurrency Control & Recovery, Transaction States, System Log, Desirable Properties of transactions.

Serial schedules, Concurrent and Serializable Schedules, Conflict equivalence and conflict serializability, Recoverable and cascade-less schedules, Locking, Two-phase locking and its variations. Log-based recovery, Deferred database modification, check-pointing.

Introduction to NoSQL Databases, Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB)

Main characteristics of Column - Family DB (examples from: Cassandra) and Graph DB (examples from : ArangoDB)

Text Books

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.
2. Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.

Reference Books:

1. Adam Fowler, NoSQL for Dummies, John Wiley & Sons, 2015
2. NoSQL Data Models: Trends and Challenges (Computer Engineering: Databases and Big Data), Wiley, 2018
3. Web Resource: https://www.w3resource.com/redis/
4. web Resource: https://www.w3schools.in/category/mongodb/
5. Web Resource: https://www.tutorialspoint.com/cassandra/cassandra_introduction.htm
6. Web Resource : https://www.tutorialspoint.com/arangodb/index.htm

Sample Course Level Assessment Questions

Course Outcome1 (CO1):

1. List out any three salient features of database systems, which distinguish it from a file system.
2. Give one example each for logical and physical data independence.

Course Outcome 2(CO2):

1. What facts about the relationships between entities EMPLOYEE and PROJECT are conveyed by the following ER diagram?

1. Design an ER diagram for the following scenario:
   There is a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs. Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses. Teams play matches, in each match there is a host team and a guest team.

Course Outcome 3(CO3):

1. For the SQL query, SELECT *A, B FROM R WHERE B='apple' AND C = 'orange'* on the table R(A, B, C, D), where A is a key, write any three equivalent relational algebra expressions.
2. Given the FDs P→Q, P→R, QR→S, Q→T, QR→U, PR→U, write the sequence of *Armstrong's Axioms* needed to arrive at the following FDs: (a) P → T (b) PR → S (c) QR → SU
3. Consider a relation PLAYER (PLAYER-NO, PLAYER-NAME, PLAYER-POSN, TEAM, TEAM-COLOR, COACH-NO, COACH-NAME, TEAM-CAPTAIN). Assume that PLAYER-NO is the *only* key of the relation and that the following dependencies hold:

   TEAM→{TEAM-COLOR, COACH-NO, TEAM-CAPTAIN}
   COACH-NO→COACH-NAME.

   i. Is the relation in 2NF? If not, decompose to 2NF.
   ii. Is the relation in 3NF? If not, decompose to 3NF.

4. In the following tables foreign keys have the same name as primary keys except DIRECTED-BY, which refers to the primary key ARTIST-ID. Consider only *single-director* movies.
   MOVIES(MOVIE-ID, MNAME, GENRE, LENGTH, DIRECTED-BY)
   ARTIST(ARTIST-ID, ANAME)
   ACTING(ARTIST-ID, MOVIE-ID)
   Write SQL expressions for the following queries:
   (a) *Name(s) and director name(s) of movie(s) acted by 'Jenny'.*
   (b) *Names of actors who have never acted with 'Rony'*
   (c) *Count of movies genre-wise.*
   (d) *Name(s) of movies with maximum length.*

Course Outcome 4(CO4):

1. Consider an EMPLOYEE file with 10000 records where each record is of size 80 bytes. The file is sorted on employee number (15 bytes long), which is the primary key. Assuming un-spanned organization, block size of 512 bytes and block pointer size of 5 bytes. Compute the number of block accesses needed for retrieving an employee record based on employee number if (i) No index is used (ii) Multi-level primary index is used.

Course Outcome 5(CO5):

1. Determine if the following schedule is *recoverable*. Is the schedule *cascade-less*? Justify your answer. *r1(X), r2(Z), r1(Z), r3(X), r3(Y), w1(X), c1, w3(Y), c3, r2(Y), w2(Z), w2(Y), c2*. (*Note: ri(X)/wi(X)* means transaction *Ti* issues read/write on item X; *ci* means transaction *Ti* commits.)
2. Two-phase locking protocol ensures serializability. Justify.

Course Outcome 6(CO6):

1. List out any three salient features of NoSQL databases. Give example of a document in MongoDB.

Model Question paper

QPCODE

Reg No:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST 204

Course Name: **Database Management Systems**

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1 List out any three salient features of a database systems.

2 When is multi-valued composite attribute used in ER modelling?

3 For the SQL query, SELECT *A, B FROM R WHERE B='apple' AND C = 'orange'* on the table R(A, B, C, D), where A is a key, write any two equivalent relational algebra expressions.

4 Outline the concept of *theta*-join.

5 How is the purpose of *where* clause is different from that of having clause?

6 What is the use of a trigger?

7 When do you say that a relation is not in 1NF?

8 Given the FDs P→Q, P→R, QR→S, Q→T, QR→U, PR→U, write the sequence of Armstrong's Axioms needed to arrive at a. P → T b. PR → S

9 What is meant by the lost update problem?

10 What is meant by check pointing?

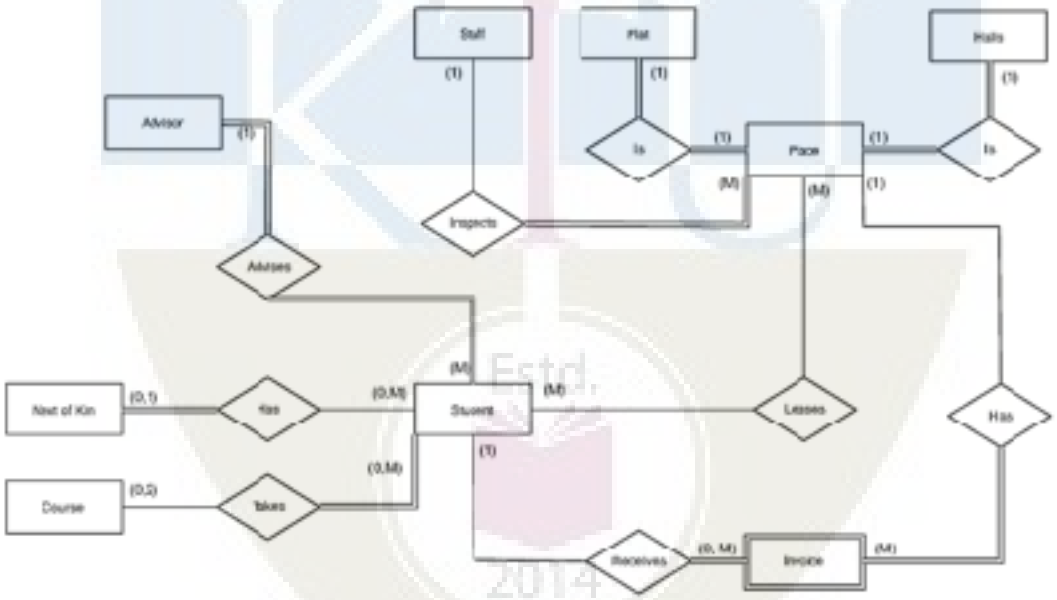
PART B

Answer any one Question from each module. Each question carries 14 Marks

11 a. Design an ER diagram for the following scenario: There is a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs. Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses. Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team. For each match we need to keep track of the following: The date on which the game is played The final result of the match. The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card. During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place. Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee. (14)

OR

12 a. Interpret the the following ER diagram. (8)



b. Distinguish between physical data independence and logical data independence with suitable examples. (6)

13 **EMPLOYEE(ENO, NAME, ADDRESS, DOB, AGE, GENDER, SALARY, DNUM, SUPERENO)**
DEPARTMENT(DNO, DNAME, DLOCATION, DPHONE, MGRENO)
PROJECT(PNO, PNAME, PLOCATION, PCOST, CDNO) (14)

DNUM is a foreign key that identifies the department to which an employee belongs. MGRENO is a foreign key identifying the employee who manages the department. CDNO is a foreign key identifying the department that controls the project. SUPERENO is a foreign key identifying the supervisor of each employee.

Write relational algebra expressions for the following queries:-

(a) Names of female employees whose salary is more than 20000.
(b) Salaries of employee from 'Accounts' department
(c) Names of employees along with his/her superviser's name
(d) For each employee return name of the employee along with his department name and the names of projects in which he/she works
(e) Names of employees working in all the departments

OR

14 a. Write SQL DDL statements for the the following (Assume suitable domain types): (10)

i. Create the tables STUDENT(ROLLNO, NAME, CLASS, SEM, ADVISER), FACULTY(FID, NAME, SALARY, DEPT). Assume that ADVISER is a foreign key referring FACUTY table.

ii. Delete department with name 'CS' and all employees of the department.

iii. Increment salary of every faculty by 10%.

b. Illustrate foreign key constraint with a typical example. (4)

15 For the relation schema below, give an expression in SQL for each of the queries that follows: (14)

employee(<u>employee-name</u>, street, city)
works(<u>employee-name, company-name</u>, salary)
company(<u>company-name</u>, city)
manages(<u>employee-name, manager-name</u>)

a) Find the names, street address, and cities of residence for all employees who work for the Company 'RIL Inc.' and earn more than $10,000.
b) Find the names of all employees who live in the same cities as the companies for which they work.
c) Find the names of all employees who do not work for 'KYS Inc.'. Assume that all people work for exactly one company.
d) Find the names of all employees who earn more than every employee of 'SB Corporation'. Assume that all people work for at most one company.
e) List out number of employees company-wise in the decreasing order of number of employees.

OR

16 a. Consider an EMPLOYEE file with 10000 records where each record is of size 80 bytes. The file is sorted on employee number (15 bytes long), which is the primary key. Assuming un-spanned organization and block size of 512 bytes compute the number of block accesses needed for selecting records based on employee number if, (9)

i. No index is used
ii. Single level primary index is used
iii. Multi-level primary index is used

Assume a block pointer size of 6 bytes.

b. Illustrate correlated and non-correlated nested queries with real examples. (5)

17 a. Illstrate3NF and BCNF with suitable real examples. (6)

b. Given a relation R(A1,A2,A3,A4,A5) with functional dependencies A1→A2A4 and A4→A5, check if the decomposition R1(A1,A2,A3), R2(A1,A4), R3(A2,A4,A5) is lossless. (8)

OR

18 a. Consider the un-normalized relation R(A, B, C, D, E, F, G) with the FDs A→B , AC→G, AD→EF, EF→G, CDE→AB. Trace the normalization process to reach 3NF relations. (7)

b. Illustrate Lossless Join Decomposition and Dependency Preserving Decomposition with typical examples. (7)

19 a. Discuss the four ACID properties and their importance. (7)

b. Determine if the following schedule is conflict serializable. Is the schedule recoverable? Is the schedule cascade-less? Justify your answers. (7)

r1(X), r2(Z), r1(Z), r3(X), r3(Y), w1(X), c1, w3(Y), c3, r2(Y), w2(Z), w2(Y), c2

(Note: ri(X)/wi(X) means transaction Ti issues read/write on item X; ci means transaction Ti commits.)

OR

20 a. Discuss the main characteristics of Key-value DB and Graph DB. (7)

b. Illustrate two-phase locking with a schedule containing three transactions. Argue that 2PL ensures serializability. Also argue that 2Pl can lead to deadlock. (7)

Teaching Plan

	Course Name	Hours (48)
	Module 1: Introduction & ER Model	**8**
1.1	Concept & Overview of DBMS, Characteristics of DB system, Database Users.	1
1.2	Structured, semi-structured and unstructured data. Data Models and Schema	1
1.3	Three-Schema-architecture. Database Languages	1
1.4	Database architectures and classification	1
1.5	ER model: basic concepts, entity set & attributes, notations	1
1.6	Relationships and constraints – cardinality, participation, notations	1
1.7	Weak entities, relationships of degree 3	1
1.8	ER diagram – exercises	1
	Module 2: Relational Model	**7**
2.1	Structure of relational Databases, Integrity Constraints	1
2.2	Synthesizing ER diagram to relational schema, Introduction to relational algebra.	1
2.3	Relational algebra: select, project, Cartesian product operations	1
2.4	Relational Algebra: join - Equi-join, Natural join	1
2.5	Query examples	1
2.6	Introduction to SQL, important data types	1
2.7	DDL, Table definitions and operations – CREATE, DROP, ALTER, INSERT, DELETE, UPDATE	1
	Module 3: SQL DML, Physical Data Organization	**11**
3.1	SQL DML, SQL queries on single and multiple tables	1
3.2	Nested queries (correlated and non-correlated)	1
3.3	Aggregation and grouping	1

	Course Name	Hours (48)
3.4	Views, assertions (with examples)	1
3.5	Triggers (with examples), SQL data types	1
3.6	Review of terms: physical and logical records, blocking factor, pinned and unpinned organization. Heap files, Indexing	1
3.7	Singe level indices, numerical examples	1
3.8	Multi-level-indices, numerical examples	1
3.9	B-Trees and B+Trees (structure only, algorithms not required)	1
3.10	Extendible Hashing	1
3.11	Indexing on multiple keys – grid files	1
	Module 4: Normalization	**8**
4.1	Different anomalies in designing a database, The idea of normalization	1
4.2	Functional dependency, Armstrong's Axioms (proofs not required)	1
4.3	Closures and their computation, Equivalence of FDs, minimal Cover (proofs not required).	1
4.4	1NF, 2NF	1
4.5	3NF, BCNF	1
4.6	Lossless join and dependency preserving decomposition	1
4.7	Algorithms for checking Lossless Join and Dependency preserving properties (Lecture 1)	1
4.8	Algorithms for checking Lossless Join and Dependency preserving properties (Lecture 2)	1
	Module 5: Transactions, Concurrency and Recovery, Recent Topics	**14**
5.1	Transaction Processing Concepts: Transaction Model	1
5.2	Overview of concurrency control, Significance of concurrency Control & Recovery	1
5.3	Transaction States, System Log	1

	Course Name	Hours (48)
5.4	Desirable Properties of transactions, Serial schedules	1
5.5	Concurrent and Serializable Schedules	1
5.6	Conflict equivalence and conflict serializability	1
5.7	Recoverable and cascade-less schedules	1
5.8	Locking, Two-phase locking, strict 2PL.	1
5.9	Log-based recovery	1
5.10	Deferred database modification (serial schedule), example	1
5.11	Deferred database modification (concurrent schedule) example, check-pointing	1
5.12	Introduction to NoSQL Databases	1
5.13	Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB) [detailed study not expected]	1
5.14	Main characteristics of Column-Family DB (examples from: Cassandra) and Graph DB (examples from : ArangoDB) [detailed study not expected]	1

CST 206	OPERATING SYSTEMS	Category	L	T	P	Credit	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: Study of operating system is an essential to understand the overall working of computer system, tradeoffs between performance and functionality and the division of jobs between hardware and software. This course introduces the concepts of memory management, device management, process management, file management and security & protection mechanisms available in an operating system. The course helps the learner to understand the fundamentals about any operating system design so that they can extend the features of operating system to detect and solve many problems occurring in operating system and to manage the computer resources appropriately.

Prerequisite: Topics covered in the courses are **Data Structures (CST 201)** and **Programming in C (EST 102)**

Course Outcomes: After the completion of the course the student will be able to

CO1	Explain the relevance, structure and functions of Operating Systems in computing devices. (**Cognitive knowledge: Understand**)
CO2	Illustrate the concepts of process management and process scheduling mechanisms employed in Operating Systems. (**Cognitive knowledge: Understand**)
CO3	Explain process synchronization in Operating Systems and illustrate process synchronization mechanisms using Mutex Locks, Semaphores and Monitors (**Cognitive knowledge: Understand**)
CO4	Explain any one method for detection, prevention, avoidance and recovery for managing deadlocks in Operating Systems. (**Cognitive knowledge: Understand**)
CO5	Explain the memory management algorithms in Operating Systems. (**Cognitive knowledge: Understand**)
CO6	Explain the security aspects and algorithms for file and storage management in Operating Systems. **(Cognitive knowledge: Understand)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓							✓		✓
CO2	✓	✓	✓	✓						✓		✓
CO3	✓	✓	✓	✓						✓		✓
CO4	✓	✓	✓	✓						✓		✓
CO5	✓	✓	✓	✓						✓		✓
CO6	✓	✓	✓	✓						✓		✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	PO#	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	Test 1 (Marks in percentage)	Test 2 (Marks in percentage)	End Semester Examination (Marks in percentage)
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3

Continuous Internal Evaluation Pattern:
Attendance : 10 marks
Continuous Assessment Test : 25 marks
Continuous Assessment Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:
There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module I

Introduction: Operating system overview – Operations, Functions, Service – System calls, Types – Operating System structure - Simple structure, Layered approach, Microkernel, Modules – System boot process.

Module II

Processes - Process states, Process control block, threads, scheduling, Operations on processes - process creation and termination – Inter-process communication - shared memory systems, Message passing systems.

Process Scheduling – Basic concepts- Scheduling criteria -scheduling algorithms- First come First Served, Shortest Job Firs, Priority scheduling, Round robin scheduling

Module III

Process synchronization- Race conditions – Critical section problem – Peterson's solution, Synchronization hardware, Mutex Locks, Semaphores, Monitors – Synchronization problems - Producer Consumer, Dining Philosophers and Readers-Writers.

Deadlocks: Necessary conditions, Resource allocation graphs, Deadlock prevention, Deadlock avoidance – Banker's algorithms, Deadlock detection, Recovery from deadlock.

Module IV

Memory Management: Concept of address spaces, Swapping, Contiguous memory allocation, fixed and variable partitions, Segmentation, Paging. Virtual memory, Demand paging, Page replacement algorithms.

Module V

File System: File concept - Attributes, Operations, types, structure – Access methods, Protection. File-system implementation, Directory implementation. Allocation methods.
Storage Management: Magnetic disks, Solid-state disks, Disk Structure, Disk scheduling, Disk formatting.

Text Book

Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, ' Operating System Concepts' 9th Edition, Wiley India 2015.

Reference Books:

1. Andrew S Tanenbaum, "Modern Operating Systems" , 4th Edition, Prentice Hall, 2015.
2. William Stallings, "Operating systems", 6th Edition, Pearson, Global Edition, 2015.
3. Garry Nutt, Nabendu Chaki, Sarmistha Neogy, "Operating Systems", 3rd Edition, Pearson Education.
4. D.M.Dhamdhere, "Operating Systems", 2nd Edition, Tata McGraw Hill, 2011.
5. Sibsankar Haldar, Alex A Aravind, "Operating Systems", Pearson Education.

Sample Course Level Assessment Questions

Course Outcome1 (CO1): What is the main advantage of the micro kernel approach to system design? How do user program and system program interact in a microkernel architecture?

Course Outcome 2 (CO2): Define process. With the help of a neat diagram explain different states of process.

Course Outcome 3 (CO3): What do you mean by binary semaphore and counting semaphore? With C, explain implementation of wait () and signal().

Course Outcome 4 (CO4): Describe resource allocation graph for the following. a) with a deadlock b) with a cycle but no deadlock.

Course Outcome 5 (CO5): Consider the following page reference string 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. Find out the number of page faults if there are 4 page frames, using the following page replacement algorithms. i) LRU ii) FIFO iii) Optimal

Course Outcome 6 (CO6): Explain the different file allocation methods with advantages and disadvantages.

Model Question Paper

QP CODE: PAGES: ___

Reg No:_____
Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST 206

Course name : OPERATING SYSTEMS

Max Marks: 100 **Duration: 3 Hours**

PART-A

(Answer All Questions. Each question carries 3 marks)

1. How does hardware find the Operating System kernel after system switch-on?
2. What is the purpose of system call in operating system?
3. Why is context switching considered as an overhead to the system?

4. How is inter process communication implement using shared memory?

5. Describe resource allocation graph for the following.

   a) with a deadlock b)with a cycle but no deadlock.

6. What is critical section? What requirement should be satisfied by a solution to the critical section problem?

7. Consider the reference string 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults occur while using FCFS for the following cases.

   a) frame=2 b)frame=3

8. Differentiate between internal and external fragmentations.

9. Compare sequential access and direct access methods of storage devices.

10. Define the terms (i) Disk bandwidth (ii) Seek time.

PART-B(Answer any one question from each module)

11. a) Explain the following structures of operating system (i) Monolithic systems (ii) Layered Systems (iii) Micro Kernel (iv) Modular approach. **(12)**

    b) Under what circumstances would a user be better of using a time sharing system than a PC or a single user workstation? **(2)**

OR

12. a) What is the main advantage of the micro kernel approach to system design? How do user program and system program interact in a microkernel architecture? **(8)**

    b) Describe the differences between symmetric and asymmetric multiprocessing? What are the advantages and disadvantages of multiprocessor systems? **(6)**

13. a) Define process. With the help of a neat diagram explain different states of process. **(8)**

    b) Explain how a new process can be created in Unix using fork system call. **(6)**

OR

14 a) Find the average waiting time and average turnaround time for the processes given in the table below using:- i) SRT scheduling algorithm ii) Priority scheduling algorithm **(9)**

Process	Arrival Time (ms)	CPU Burst Time (ms)	Priority
P1	0	5	3
P2	2	4	1
P3	3	1	2
P4	5	2	4

b) What is a Process Control Block? Explain the fields used in a Process Control Block. **(5)**

15. Consider a system with five processes P_0 through P_4 and three resources of type A, B, C. Resource type A has 10 instances, B has 5 instances and C has 7 instances. Suppose at time t_0 following snapshot of the system has been taken:

Process	Allocation	Max	Available
	A B C	A B C	A B C
P_0	0 1 0	7 5 3	3 3 2
P_1	2 0 0	3 2 2	
P_2	3 0 2	9 0 2	
P_3	2 1 1	2 2 2	
P_4	0 0 2	4 3 3	

i) What will be the content of the Need matrix? Is the system in a safe state? If Yes, then what is the safe sequence? **(8)**

iii)What will happen if process P_1 requests one additional instance of resource type A and two instances of resource type C? **(6)**

OR

16. a) State dining philosopher's problem and give a solution using semaphores. **(7)**

b) What do you mean by binary semaphore and counting semaphore? With C struct, explain implementation of wait () and signal() **(7)**

17. a) Consider the following page reference string 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. Find out the number of page faults if there are 4 page frames, using the following page replacement algorithms i) LRU ii) FIFO iii) Optimal **(9)**

b) Explain the steps involved in handling a page fault. **(5)**

OR

18. a) With a diagram, explain how paging is done with TLB. **(5)**

b) Memory partitions of sizes 100 kb, 500 kb, 200 kb, 300 kb, 600 kb are available, how would best ,worst and first fit algorithms place processes of size 212 kb, 417 kb, 112 kb, 426 kb in order. Rank the algorithms in terms of how efficiently they uses memory. **(9)**

19. a) Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. the drive currently services a request at cylinder 143, and the previous request was at cylinder 125. the queue of pending request in FIFO order is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from the current position, what is the total distance (in cylinders) that the disk arm moves to satisfy all pending requests for each of the following algorithms

i) FCFS ii) SSFT iii) SCAN iv) LOOK v) C-SCAN **(10)**

b) What is the use of access matrix in protection mechanism? **(4)**

OR

20. a) Explain the different file allocation operations with advantages and disadvantages. **(8)**

b) Explain the following i) file types ii) file operation iii) file attributes **(6)**

Teaching Plan

	Module 1 - Introduction	**5 Hours**
1.1	Introduction to Operating System	1
1.2	Operating System operations, functions, service	1
1.3	System calls, Types	1
1.4	Operating System Structure: Simple, Layered, Microkernel, Modules	1
1.5	System Boot Process	1
	Module 2 – Processes and Process Scheduling	**9 Hours**
2.1	Processes, Process states	1
2.2	Process Control Block, Threads	1

2.3	Scheduling	1
2.4	Operations on processes: process creation and termination	1
2.5	Inter-process communication: Shared memory systems, Message Passing	1
2.6	Process Scheduling – Basic concepts, Scheduling Criteria	1
2.7	Scheduling algorithms - Basics	1
2.8	First come First Served, Shortest Job First	1
2.9	Priority scheduling, Round Robin Scheduling	1
	Module 3 - Process synchronization and Dead locks	**13 Hours**
3.1	Process synchronization, Race conditions	1
3.2	Critical Section problem, Peterson's solution	1
3.3	Synchronization hardware, Mutex Locks	1
3.4	Semaphores	1
3.5	Monitors	1
3.6	Synchronization problem examples (Lecture 1)	1
3.7	Synchronization problem examples (Lecture 2)	1
3.8	Deadlocks: Necessary conditions, Resource Allocation Graphs	1
3.9	Deadlock prevention	1
3.10	Deadlock avoidance	1
3.11	Banker's algorithm	1
3.12	Deadlock detection	1
3.13	Deadlock recovery	1
	Module 4 - Memory Management	**9 Hours**
4.1	Memory Management: Concept of Address spaces	1
4.2	Swapping	1
4.3	Contiguous memory allocation, fixed and variable partitions	1
4.4	Segmentation.	1
4.5	Paging (Lecture 1)	1
4.6	Paging (Lecture 2)	1
4.7	Virtual memory, Demand Paging	1

4.8	Page replacement algorithms (Lecture 1)	1
4.9	Page replacement algorithms (Lecture 2)	1
	Module 5 - File and Disk management	**9 Hours**
5.1	File concept, Attributes, Operations, types, structure	1
5.2	Access methods	1
5.3	Protection	1
5.4	File-System implementation	1
5.5	Directory implementation	1
5.6	Allocation methods	1
5.7	Magnetic disks, Solid-state disks, Disk structure	1
5.8	Disk scheduling	1
5.9	Disk formatting	1

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
KTU
Estd. 2014

CCL202	SCRIPTING LANGUAGES FOR SECURITY	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2020

Preamble: The course aims to offer hands-on experience for learners in Python programming and Shell Scripting for security implementations. It covers basic shell commands, shell scripting, python programming constructs and its use in security applications. The course helps the learners to get practical exposure on security related issues and its solutions.

Prerequisite: Basic concepts in any Programming Language

Course Outcomes:

At the end of the course, the student should be able to

CO1	Develop simple applications and file operations in shell script (**Cognitive Knowledge Level: Apply**)
CO2	Illustrate the use of shell scripting in security applications (**Cognitive Knowledge Level: Apply**)
CO3	Implement control structures, iterations, string operations and recursive functions in Python (**Cognitive Knowledge Level: Apply**)
CO4	Implement security operations on files using python (**Cognitive Knowledge Level: Apply**)
CO5	Develop security related programs using python libraries(**Cognitive Knowledge Level: Apply**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓			✓		✓		✓
CO2	✓	✓	✓	✓	✓			✓		✓		✓
CO3	✓	✓	✓		✓			✓		✓		✓
CO4	✓	✓	✓	✓	✓			✓		✓		✓

CO5	✓	✓	✓	✓	✓			✓		✓		✓

Abstract Pos defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and teamwork
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Lifelong learning

Assessment Pattern

Bloom's Category	**Continuous Assessment Test(Internal Exam) Mark in Percentage**	**End Semester Examination Mark in Percentage**
Remember	20	20
Understand	20	20
Apply	60	60
Analyze		
Evaluate		
Create		

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
150	**75**	**75**	**3hours**

Continuous Internal Evaluation Pattern:

Attendance : 15marks
Continuous Evaluation in Lab : 30marks
Continuous Assessment Test : 15marks
Viva-voce : 15marks

Internal Examination Pattern: The marks will be distributed as Algorithm 20 marks, Program 30 marks, Output 20 marks and Viva 30 marks. Total 100 marks which will be converted out of 15 while calculating Internal Evaluation marks.

End Semester Examination Pattern: The marks will be distributed as Algorithm 20 marks, Program 30 marks, Output 20 marks and Viva 30 marks. Total 100 marks will be converted out of 75 for End Semester Examination.

Operating System to Use in Lab :Unix/Linux

Compiler/Software to Use in Lab : Bash Shell / Python

Interpreter Language to Use in Lab : Shell Script / Python

Fair Lab Record:

All Students attending the Scripting Languages for security lab should have a Fair Record. The fair record should be produced in the University Lab Examination. Every experiment conducted in the lab should be noted in the fair record. For every experiment in the fair record the right-hand page should contain Experiment Heading, Experiment Number, Date of Experiment, Aim of Experiment, Details of Experiment including Algorithm and Result of Experiment. The left-hand page should contain a print out of the code used for the experiment and sample output obtained for a set of inputs.

SYLLABUS

Shell Scripting

Programs using Basic Linux Shell Commands : Interactive shell script, Positional parameters, Arithmetic operators, Logical operators, Selection and Iterative Control statements, Meta characters

Programs using Basic Unix Shell Commands: Creation of class directory, User file creation, User log history, Script escalation, Hash for files, Denial of Execution.

Python

Variables, Expressions Decision making, Branching, Conditional statements, Iterative statements.

Function: Function calls, Math functions,Parameters and arguments, Adding new functions, Recursion

Files: Operations, Access Privileges

MD5 Hash, Primality Testing: Miller-Rabin Method, Pseudo Random number Generation, Packet Capture

PRACTICAL QUESTIONS IN SHELL SCRIPTING

1. Write a shell script to create a file in $USER/class/batch directory
2. Write a shell script to display the list of files in a directory?
3. Write shell script for showing the count of users logged in.
4. Write a shell script to print file names in directory showing date of creation & serial number of file.
5. Write a shell script to count lines, words & characters in its input.(do not use wc)
6. Write a shell script to print end of a Glossary file in reverse order using array.
7. Write a shell script to check whether a user has logged in, continue checking further after every 30 seconds till success.
8. Write a shell script to check access to root and stop escalation to root from another script.
9. Write a shell script to test file integrity. Create hash for files and check changes.
10. Write a shell script to check access from users other than in white list
11. Write a shell script to check any shell script running.
12. Write a shell script to deny exec right to another program.

PRACTICAL QUESTIONS IN PYTHON

(Implement minimum of 6 experiments from Part B)

PART A

1. Write a program to print the factors of a given number.
2. Write a program to check whether a given number is prime or not
3. Write a program to check whether a number is palindrome or not
4. Write a Python program to read a list of numbers and sort the list in a non-decreasing order without using any built-in functions. Separate function should be written to sort the list where in the name of the list is passed as the parameter.
5. Find the factorial of a given Natural Number ***n*** using recursive functions.

PART B

6. Write a program to check the complexity of a password.
7. Write a program to implement Primality testing using Miller-Rabin Method
8. Write a program to implement MD5 hash
9. Write a program to search for deleted files in python
10. Write a program to check for presence of dark web.
11. Write a program to implement privilege escalation and evasion
12. Write a Key logger / key logger detection tool program using python
13. Write a program to detect access from invalid IP address using packet capture.
14. Write a program to implement pseudo random number generation
15. Write a program to list images, pdf in a file given.

Micro Project: Students are expected to do a micro project preferably related to the security aspects(Python).

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CCL204	OS AND DBMS LAB	CATEGORY	L	T	P	CREDITS
		PCC	0	0	3	2

Preamble: The course aims to offer students a hands-on experience on Operating System concepts and Database design.This course helps the learners to get practical exposure on Process synchronization, CPU scheduling, deadlock, memory allocation, memory management, database creation, SQL queries creation and PL/SQL. The course enables the students to develop real world application involving OS and Database constructs.

Prerequisite: A sound knowledge of the basics of relational DBMS and Operating Systems.

Course Outcomes: After the completion of the course the student will be able to

CO1	Implement Process Creation, Inter Process Communication and CPU Scheduling algorithms in Operating Systems. **(Cognitive knowledge: Apply)**
CO2	Illustrate the performance of First In First Out, Least Recently Used and Least Frequently Used Page Replacement Algorithms.
C03	Implement modules for Deadlock Detection and Deadlock Avoidance in Operating Systems. **(Cognitive knowledge: Apply)**
C04	Construct queries using SQL for database creation, interaction, modification, and updation. **(Cognitive Knowledge Level: Apply)**
CO5	Implement procedures, functions, and control structures using PL/SQL. **(Cognitive Knowledge Level: Apply)**
C06	Develop database applications using front-end tools and back-end DBMS. **(Cognitive Knowledge Level: Create)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓			✓		✓		✓
CO2	✓	✓	✓	✓	✓			✓		✓		✓
CO3	✓	✓	✓	✓	✓			✓		✓		✓
CO4	✓	✓	✓		✓			✓		✓		✓
CO5	✓	✓	✓	✓	✓			✓		✓		✓
CO6	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex Problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern:

Bloom's Category	Continuous Assessment Test (Internal Exam) Marks in percentage	End Semester Examination Marks in percentage
Remember	20	20
Understand	20	20
Apply	60	60
Analyze		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	75	75	3 hours

Continuous Internal Evaluation Pattern:

Attendance	:	15 marks
Continuous Evaluation in Lab	:	30 marks
Continuous Assessment Test	:	15 marks
Viva Voce	:	15 marks

Internal Examination Pattern: The marks will be distributed as Algorithm 30 marks, 20 marks for program, 20 marks for output and 30 marks for viva. In DBMS experiments, marks will be distributed as Schema/Form Design/Queries 50 marks, 20 marks for output, and 30 marks for viva. Total 100 marks which will be converted out of 15 while calculating Internal Evaluation marks.

End Semester Examination Pattern: The percentage of marks will be distributed as Algorithm 30 marks, Program 20 marks, Output 20 marks and Viva 30 marks. Total 75 marks.

Operating System to Use in Lab : Linux/Windows
Compiler/Software to Use in Lab : gcc
Progamming Language to Use in Lab : Ansi C
DBMS software: Oracle, MySQL
Front end Tool: Java

Fair Lab Record:

All Students attending the OS AND DBMS Lab should have a Fair Record. The fair record should be produced in the University Lab Examination. Every experiment conducted in the lab should be noted in the fair record. For every experiment in the fair record, the right hand page should contain experiment heading, experiment number, date of experiment.

In the case Operating System experiments, the right hand page also contains aim, algorithm and output. The left hand page should contain a print out of the code used for experiment and sample output obtained for a set of input.

In the case of DBMS Lab, the right hand page also contains Schemas/Menu & Form Design, and Query questions. The left hand page should contain queries and sample output (relations created, Form, and Menu Output) obtained for a set of input.

SYLLABUS

Operating System

1. Implement programs for Inter Process Communication using Shared Memory.
2. Implement Semaphores.
3. Implementation of CPU scheduling algorithms. a) Round Robin b) SJF c) FCFS d)Priority
4. Implementation of the Memory Allocation Methods for fixed partition.
   i. First Fit b) Worst Fit c) Best Fit
5. Implement page replacement algorithms a) FIFO b) LRU c) LFU
6. Implement the Banker's algorithm for deadlock avoidance.
7. Implementation of Deadlock detection algorithm.

Database Management System

8. Creation, modification, configuration, and deletion of databases using UI and SQL Commands.
9. DDL and DML commands -(insertion, updating, set constraints, altering, deletion of data, and viewing/querying records based on condition in databases) .
10. Implementation of built-in functions in RDBMS .
11. Implementation of Order By, Group By & Having clause .
12. Implementation of various control structures like IF-THEN, IF-THEN-ELSE, IF-THEN-ELSIF, CASE, WHILE using PL/SQL .
13. Implementation of set operators nested queries, and join queries

14. Design a database application using any front end tool for any problem selected. The application constructed should have five or more tables.

OS AND DBMS LAB-PRACTICE QUESTIONS
(Minimum six experiments from Operating Systems)

1. Given the list of processes, their CPU burst times and arrival times, print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
2. Write a C program to simulate following non-pre-emptive CPU scheduling algorithms tofind turnaround time and waiting time.
   a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority
3. Write a C program to simulate following contiguous memory allocation techniques
   a) Worst-fit b) Best-fit c) First-fit
4. Write a C program to simulate paging technique of memory management.
5. Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.
6. Write a C program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN
7. Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU
8. Write a C program to simulate producer-consumer problem using semaphores.
9. Write a C program to simulate algorithm for deadlock prevention.
10. Creation of a database using DDL commands and write DQL queries to retrieve information from the database.
11. Performing DML commands like Insertion, Deletion, Modifying, Altering, and Updating records based on conditions.
12. Creating a database to set various constraints.
13. Practice of SQL TCL commands like Rollback, Commit, Savepoint.
14. Creation of Views and Assertions
15. Implementation of Built-in functions in RDBMS
16. Implementation of various aggregate functions in SQL
17. Implementation of Order By, Group By& Having clause.
18. Implementation of set operators, nested queries and Join queries
19. Implementation of various control structures using PL/SQL
20. Mini project (Application Development using Oracle/ MySQL using Database connectivity like)
    a. Hospital Management System.
    b. Railway Reservation System.
    c. Personal Information System.
    d. Web Based User Identification System.
    e. Timetable Management System.
    f. Hotel Management System.

SEMESTER IV

HONOURS

CCT292	SECURE MOBILE APPLICATION DEVELOPMENT	CATEGORY	L	T	P	CREDITS
		VAC	3	1	0	4

Preamble: This course helps the learners to make awareness about strong theoretical concept in the development of mobile applications and its challenges. It covers the concepts of Mobile App and Mobile Interface, key concepts of Android, 2D graphics and multimedia in Android, User interface design, SQLite database, mobile embedded system architecture and mobile cloud. This course enables the learners to develop the ability to create Android based applications for different domains.

Prerequisite: A sound knowledge in Java.

Course Outcomes: After the completion of the course the student will be able to

CO#	CO
CO1	Describe the concepts, security challenges in mobile system and mobile applications **(Cognitive Knowledge level: Understand)**
CO2	Implement 2D graphics, Graphical User Interface and incorporate multimedia in Android applications **(Cognitive Knowledge level: Apply)**
CO3	Explain the concepts of general and Android based mobile embedded systems and its application, processor technology and scheduling algorithms**(Cognitive Knowledge level: Understand)**
CO4	Illustrate the storage of data from mobile applications to a mobile device **(Cognitive Knowledge level: Apply)**
CO5	Describe the techniques employed in mobile cloud**(Cognitive Knowledge level: Understand)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										✓
CO2	✓	✓	✓		✓							✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓
CO5	✓	✓										✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test 1 (%)	Test 2 (%)	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3

Continuous Internal Evaluation Pattern:

Attendance **10 marks**

Continuous Assessment Tests (Average of SeriesTests1& 2) **25 marks**

Continuous Assessment Assignment **15 marks**

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. The first series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing the remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 full questions from each module of which student should answer any one full question. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

Module – 1(Overview of Mobile App and Mobile Interface)

Mobile Systems. Mobile Interface and Applications - Optimizations in Mobile Systems, Mobile Embedded System. Mobile Cloud - Big Data Application in Mobile Systems, Data Security and Privacy Protection in Mobile Systems, Concept of Mobile Apps, Brief Introduction of Android and its Framework. Installation and creation of Android application. Introduction to Key Concepts of Android- App Components, App Resources, App Manifest.

Module - 2(2D Graphics and Multimedia in Android)

Introduction to 2-D Graphics Techniques. Advanced UI Design. Overview of Multimedia in Android. Audio Implementation in Android. Executing Video in Android.

Module - 3 (Mobile Embedded System Architecture)

Embedded Systems. Scheduling algorithms – FCFS, SJF, Multiprocessors, Priority scheduling, As-Soon-As-Possible(ASAP) and As-Late-As-Possible(ALAP). Memory Technology. Mobile Embedded systems. Messaging and Communication mechanisms.

Module - 4 (Data storage and SQLite Operations)

Local Data - Internal and External Storage, Save a File on Internal Storage, Save a File on External Storage, Delete a File, Query the Space. SQLite Database - Table Structure, CRUD Operations, Usage of SQLite Techniques. Content Provider.

Module - 5 (Mobile Cloud Computing in Mobile Applications Deployment)

Concepts of mobile cloud computing - Technological Structure, Differences between Cloud Computing and Mobile Cloud, Mobile Computing, Wireless LAN, Wireless, WAN and Cellular

networks. Main techniques of mobile cloud computing – Virtualization, Parallel Programming Model, Mass Distributed Storage. Mobile Cloud Computing Architecture.

Text Books

1. Meikang Qiu, Wenyun Dai, and Keke Gai, Mobile Applications Development with Android Technologies and Algorithms, Taylor and Francis, 2017

References

1) Corinne Hoisington, Android Boot Camp for Developers using JavaTM, Comprehensive: A Beginner's Guide to Creating Your First Android Apps, 3e,2017
2) James C. Sheusi, Android Application Development for Java, 2013

Course Level Assessment Questions

Course Outcome 1 (CO1):

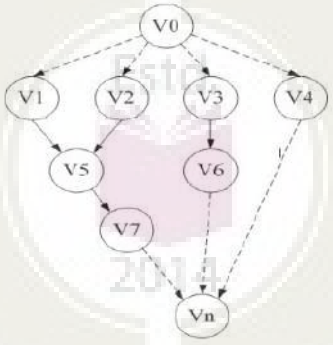
1. Explain the process of producing an Android app in mobile.
2. Illustrate the importance of look and feel of on screen system in mobile applications.

Course Outcome 2 (CO2):

1. Implement an Android project named "Rock-Paper-Scissors" Game (Programming Assignment). The basic function may cover the following aspects:
   a. Basic UI of this Android Project
   b. Basic functions of this Android Project

Course Outcome 3 (CO3):

1. Consider the figure given below and use the ASAP and ALAP algorithms to analyze them, and draw charts to explain them.



A DAG G-(V, E, D) and
d1=d2=d3=d4=d5=d6=d7=1; d0=dn=0

2. Consider that there are six jobs with different completion times and arrival times, as shown in below. Use the FCFS scheduling algorithm to schedule these jobs. You can draw a chart to answer this question.

Jobs	Arrival Time	Processing Time
j1	0.0	7
j2	2.0	4
j3	3.0	1
j4	5.0	4
j5	6.0	5
j6	8.0	3

Course Outcome 4 (CO4):

1. Implement the CRUD operations possible in SQLite in an Android application (Programming Assignment).
2. Illustrate data sharing concepts among multiple applications in Android.

Course Outcome 5 (CO5):

1. Explain mobile cloud computing architecture with proper illustrations.
2. Compare any five wireless network types with respect to various possible parameters.

Model Question Paper

QP CODE:

Reg No: _____

Name: _____ **PAGES : 4**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE(HONOURS) EXAMINATION, MONTH & YEAR

Course Code: CCT292

Course Name: Secure Mobile Application Development

Max. Marks : 100 **Duration: 3 Hours**

PART A

Answer All Questions. Each Question Carries 3 Marks

1. List any three constraints in a mobile system.
2. Differentiate between an App and Application.
3. List three key functions of *Action bar* design element of Android.
4. Mention four basic properties of a well designed Custom view.
5. Give three reasons that justify the importance of Embedded system in Mobile applications.
6. What are the key metrics used to measure the memory performance of an Embedded system?

7. Specify common methods for reading and writing data provided by the *Context* class?

8. Write an Android code snippet to get the current available space and total space in the internal storage

9. Specify two main workload migrations of implementing mobile cloud computing.

10. Define cloud mass storage.

(10x3=30)

Part B

(Answer any one question from each module. Each question carries 14 Marks)

11. (a) Explain the process of developing an Android App. **(5)**

    (b) Describe the structure of Android system architecture. **(9)**

OR

12. (a) Explain the need of data security and privacy protection in mobile systems. **(7)**

    (b) Describe the main structure of mobile cloud computing and their challenges. **(7)**

13. (a) Describe different types of drawables supported by Android. **(7)**

    (b) Explain the life cycle of a Media player with a state diagram. **(7)**

OR

14. (a) Explain the steps involved in developing a program to execute a video in Android application. **(9)**

    (b) Explain persistent application data storage in Android. **(5)**

15. (a) Illustrate ASAP and ALAP scheduling algorithms. **(10)**

    (b) List five criteria that should be considered for developing a scheduling algorithm **(4)**

OR

16. (a) Illustrate the working of the kernel inside the Android. **(7)**

(b) Explain various Android message mechanisms. **(7)**

17. (a) Explain how a file can be saved in internal storage and external storage in an Android application. **(10)**

(b) Describe the mechanism used in Android to delete a file. **(4)**

OR

18. (a) Illustrate the CRUD operations possible in SQLite. **(8)**

(b) Explain how data sharing is achieved among multiple applications in Android. **(6)**

19. (a) Differentiate between mobile cloud and cloud computing with proper illustrations. **(4)**

(b) Compare any five wireless network types in terms of type, performance and coverage capability. **(10)**

OR

20. (a) Differentiate between Wimax and Wifi. **(4)**

(b) Describe three schemas in mobile cloud computing architecture. **(10)**

TEACHING PLAN

No	Contents	No of Lecture Hrs (45 Hours)
Module – 1 (Overview of Mobile App and Mobile Interface) (10 hrs)		
1.1	Mobile Systems. Mobile Interface And Applications- Optimizations in Mobile Systems, Mobile Embedded System.	1
1.2	Mobile Cloud- Big Data Application in Mobile Systems, Data Security and Privacy Protection in Mobile Systems	1
1.3	Concept of Mobile Apps, Brief Introduction of Android	1
1.4	Android Device distribution	1
1.5	Android SDK	1
1.6	Installation and creation of Android application	1

1.7	Introduction to Key Concepts of Android- App Components, App Resources	1
1.8	Introduction to App Manifest	1
1.9	Illustration of App Manifest	1
1.10	Illustration of App Manifest	1
Module - 2 (2D graphics techniques and Multimedia in Android) (10 hrs)		
2.1	Introduction of 2D graphics techniques	1
2.2	Illustration of usage of graphics tool to draw the screen	1
2.3	Illustration of usage of graphics tool to draw the screen	1
2.4	Advanced UI design-Multiple screens	1
2.5	Advanced UI design-Action bar and Custom view	1
2.6	Developing UI design of an Android system	1
2.7	Overview of multimedia in Android	1
2.8	Audio implementation in Android	1
2.9	Executing video in Android	1
2.10	Developing program to execute multimedia in Android	1
Module - 3 (Mobile Embedded System Architecture) (10 hrs)		
3.1	Embedded system Overview, Introduction to scheduling algorithm	1
3.2	FCFS,SJF	1
3.3	Multiprocessor scheduling algorithm, priority scheduling	1
3.4	As Soon As Possible(ASAP)	1
3.5	As Late As Possible(ALAP)	1
3.6	Embedded system in Mobile devices	1
3.7	Embedded Systems in Android	1
3.8	Power Management of Android	1
3.9	Embedded Systems in Mobile Apps	1
3.10	Messaging and Communication Mechanisms	1
Module - 4 (Data storage and SQLite Operations (9 hrs)		
4.1	Local Data - Internal and External Storage-Save a file	1
4.2	Local Data - Delete file, Query the space	1
4.3	SQLite Database - Table Structure	1
4.4	SQLite Database - CRUD Operations	1
4.5	Illustration of CRUD Operations in SQLite Database	1
4.6	Usage of SQLite Techniques	1
4.7	Illustration of the usage of SQLite Techniques	1

4.8	Content Provider	1
4.9	Content Provider	1
Module - 5 (Mobile Cloud Computing in Mobile Applications Deployment)(6 hrs)		
5.1	Introduction of mobile cloud computing - Technological Structure, Differences between Cloud Computing and Mobile Cloud	1
5.2	Concepts of mobile cloud computing and mobile computing	1
5.3	Wireless LAN, Wireless WAN and Cellular networks	1
5.4	Main techniques of mobile cloud computing – Virtualization	1
5.5	Parallel Programming Model, Mass Distributed Storage	1
5.6	Mobile Cloud Computing Architecture	1

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
KTU
Estd. 2014

CODE CST294	COMPUTATIONAL FUNDAMENTALS FOR MACHINE LEARNING	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

Preamble: This is the foundational course for awarding B. Tech. Honours in Computer Science and Engineering with specialization in ***Machine Learning***. The purpose of this course is to introduce mathematical foundations of basic Machine Learning concepts among learners, on which Machine Learning systems are built. This course covers Linear Algebra, Vector Calculus, Probability and Distributions, Optimization and Machine Learning problems. Concepts in this course help the learners to understand the mathematical principles in Machine Learning and aid in the creation of new Machine Learning solutions, understand & debug existing ones, and learn about the inherent assumptions & limitations of the current methodologies.

Prerequisite: A sound background in higher secondary school Mathematics.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Make use of the concepts, rules and results about linear equations, matrix algebra, vector spaces, eigenvalues & eigenvectors and orthogonality & diagonalization to solve computational problems (Cognitive Knowledge Level: **Apply**)
CO 2	Perform calculus operations on functions of several variables and matrices, including partial derivatives and gradients (Cognitive Knowledge Level: **Apply**)
CO 3	Utilize the concepts, rules and results about probability, random variables, additive & multiplicative rules, conditional probability, probability distributions and Bayes' theorem to find solutions of computational problems (Cognitive Knowledge Level: **Apply**)
CO 4	Train Machine Learning Models using unconstrained and constrained optimization methods (Cognitive Knowledge Level: **Apply**)
CO 5	Illustrate how the mathematical objects - linear algebra, probability, and calculus can be used to design machine learning algorithms (Cognitive Knowledge Level: **Understand**)

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	√	√	√	√								√
CO 2	√	√	√									√
CO 3	√	√	√	√								√
CO 4	√	√	√	√		√						√
CO 5	√	√	√	√	√	√				√		√

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination**
	1	**2**	
Remember	20%	20%	20%
Understand	40%	40%	40%
Apply	40%	40%	40%
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
150	**50**	**100**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Tests : 25 marks

Continuous Assessment Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks

First Internal Examination shall be preferably conducted after completing the first half of the syllabus and the Second Internal Examination shall be preferably conducted after completing remaining part of the syllabus.

There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly covered module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly covered module), each with 7 marks. Out of the 7 questions in Part B, a student should answer any 5.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer anyone. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module 1

LINEAR ALGEBRA : Systems of Linear Equations – Matrices, Solving Systems of Linear Equations. Vector Spaces - Linear Independence, Basis and Rank, Linear Mappings, Norms, - Inner Products - Lengths and Distances - Angles and Orthogonality - Orthonormal Basis - Orthogonal Complement - Orthogonal Projections. Matrix Decompositions - Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation.

Module 2

VECTOR CALCULUS : Differentiation of Univariate Functions - Partial Differentiation and Gradients, Gradients of Vector Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients. Back propagation and Automatic Differentiation - Higher Order Derivatives- Linearization and Multivariate Taylor Series.

Module 3

Probability and Distributions : Construction of a Probability Space - Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem. Summary Statistics and Independence – Important Probability distributions - Conjugacy and the Exponential Family - Change of Variables/Inverse Transform.

Module 4

Optimization : Optimization Using Gradient Descent - Gradient Descent With Momentum, Stochastic Gradient Descent. Constrained Optimization and Lagrange Multipliers - Convex Optimization - Linear Programming - Quadratic Programming.

Module 5

CENTRAL MACHINE LEARNING PROBLEMS : Data and Learning Model- Empirical Risk Minimization - Parameter Estimation - Directed Graphical Models.

Linear Regression - Bayesian Linear Regression - Maximum Likelihood as Orthogonal Projection.

Dimensionality Reduction with Principal Component Analysis - Maximum Variance Perspective, Projection Perspective. Eigenvector Computation and Low Rank Approximations.

Density Estimation with Gaussian Mixture Models - Gaussian Mixture Model, Parameter Learning via Maximum Likelihood, EM Algorithm.

Classification with Support Vector Machines - Separating Hyperplanes, Primal Support Vector Machine, Dual Support Vector Machine, Kernels.

Text book:

1.Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong published by Cambridge University Press (freely available at https:// mml - book.github.io)

Reference books:

1. Linear Algebra and Its Applications, 4th Edition by Gilbert Strang

2. Linear Algebra Done Right by Axler, Sheldon, 2015 published by Springer

3. Introduction to Applied Linear Algebra by Stephen Boyd and Lieven Vandenberghe, 2018 published by Cambridge University Press

4. Convex Optimization by Stephen Boyd and Lieven Vandenberghe, 2004 published by Cambridge University Press

5. Pattern Recognition and Machine Learning by Christopher M Bishop, 2006, published by Springer

6. Learning with Kernels – Support Vector Machines, Regularization, Optimization, and Beyond by Bernhard Scholkopf and Smola, Alexander J Smola, 2002, bublished by MIT Press

7. Information Theory, Inference, and Learning Algorithms by David J. C MacKay, 2003 published by Cambridge University Press

8. Machine Learning: A Probabilistic Perspective by Kevin P Murphy, 2012 published by MIT Press.

9. The Nature of Statistical Learning Theory by Vladimir N Vapnik, 2000, published by Springer

Sample Course Level Assessment Questions.

Course Outcome 1 (CO1):

1. Find the set ***S*** of all solutions in ***x*** of the following inhomogeneous linear systems ***Ax*** = ***b***, where ***A*** and ***b*** are defined as follows:

$$A = \begin{bmatrix} 1 & -1 & 0 & 0 & 1 \\ 1 & 1 & 0 & -3 & 0 \\ 2 & -1 & 0 & 1 & -1 \\ -1 & 2 & 0 & -2 & -1 \end{bmatrix}, \quad b = \begin{bmatrix} 3 \\ 6 \\ 5 \\ -1 \end{bmatrix}$$

2. Determine the inverses of the following matrix if possible

$$A = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

3. Are the following sets of vectors linearly independent?

$$x_1 = \begin{bmatrix} 2 \\ -1 \\ 3 \end{bmatrix}, \quad x_2 = \begin{bmatrix} 1 \\ 1 \\ -2 \end{bmatrix}, \quad x_3 = \begin{bmatrix} 3 \\ -3 \\ 8 \end{bmatrix}$$

4. A set of ***n*** linearly independent vectors in R^n forms a basis. Does the set of vectors **(2, 4,−3)** , **(0, 1, 1)** , **(0, 1,−1**) form a basis for R^3? Explain your reasons.
5. Consider the transformation ***T (x, y) = (x + y, x + 2y, 2x + 3y)***. Obtain ***ker T*** and use this to calculate the nullity. Also find the transformation matrix for ***T***.

6. Find the characteristic equation, eigenvalues, and eigenspaces corresponding to each eigenvalue of the following matrix

$$\begin{bmatrix} 2 & 0 & 4 \\ 0 & 3 & 0 \\ 0 & 1 & 2 \end{bmatrix}$$

7. Diagonalize the following matrix, if possible

$$\begin{bmatrix} 3 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 1 & 0 & 0 & 3 \end{bmatrix}$$

8. Find the singular value decomposition (SVD) of the following matrix

$$\begin{bmatrix} 0 & 1 & 1 \\ \sqrt{2} & 2 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

Course Outcome 2 (CO2):

1. For a scalar function $f(x, y, z) = x^2 + 3y^2 + 2z^2$, find the gradient and its magnitude at the point **(1, 2, -1)**.
2. Find the maximum and minimum values of the function $f(x, y) = 4x + 4y - x^2 - y^2$ subject to the condition $x^2 + y^2 <= 2$.
3. Suppose you were trying to minimize $f(x, y) = x^2 + 2y + 2y^2$. Along what vector should you travel from (5, 12)?
4. Find the second order Taylor series expansion for $f(x, y) = (x + y)^2$ about **(0 , 0)**.
5. Find the critical points of $f(x, y) = x^2 - 3xy + 5x - 2y + 6y^2 + 8$.
6. Compute the gradient of the Rectified Linear Unit (ReLU) function $ReLU(z) = max(0 , z)$.
7. Let $L = ||Ax - b||^2_2$, where A is a matrix and x and b are vectors. Derive dL in terms of dx.

Course Outcome 3 (CO3):

1. Let ***J*** and ***T*** be independent events, where ***P(J)=0.4*** and ***P(T)=0.7***.
   - ***i.*** Find ***P(J∩T)***
   - ***ii.*** Find ***P(J∪T)***
   - ***iii.*** Find ***P(J∩T')***
2. Let ***A*** and ***B*** be events such that ***P(A)=0.45*** , ***P(B)=0.35*** and ***P(A∪B)=0.5***. Find ***P(A|B)***.
3. A random variable **R** has the probability distribution as shown in the following table:

r	1	2	3	4	5
P(R=r)	0.2	a	b	0.25	0.15

   i. Given that ***E(R)=2.85***, find ***a*** and ***b***.

   ii. Find ***P(R>2)***.

4. A biased coin (with probability of obtaining a head equal to $p > 0$) is tossed repeatedly and independently until the first head is observed. Compute the probability that the first head appears at an even numbered toss.
5. Two players A and B are competing at a trivia quiz game involving a series of questions. On any individual question, the probabilities that A and B give the correct answer are ***p*** and ***q*** respectively, for all questions, with outcomes for different questions being independent. The game finishes when a player wins by answering a question correctly. Compute the probability that A wins if

   i. A answers the first question,

   ii. B answers the first question.

6. A coin for which ***P(heads) = p*** is tossed until two successive tails are obtained. Find the probability that the experiment is completed on the n^{th} toss.
7. You roll a fair dice twice. Let the random variable ***X*** be the product of the outcomes of the two rolls. What is the probability mass function of ***X***? What are the expected value and the standard deviation of ***X***?

8. While watching a game of Cricket, you observe someone who is clearly supporting Mumbai Indians. What is the probability that they were actually born within 25KM of Mumbai? Assume that:
    - the probability that a randomly selected person is born within 25KM of Mumbai is 1/20;
    - the chance that a person born within 25KMs of Mumbai actually supports MI is 7/10 ;
    - the probability that a person not born within 25KM of Mumbai supports MI with probability 1/10.
9. What is an exponential family? Why are exponential families useful?
10. Let Z_1 and Z_2 be independent random variables each having the standard normal distribution. Define the random variables X and Y by $X = Z_1 + 3Z_2$ and $Y = Z_1 + Z_2$. Argue that the joint distribution of (X, Y) is a bivariate normal distribution. What are the parameters of this distribution?
11. Given a continuous random variable x, with cumulative distribution function $F_x(x)$, show that the random variable $y = F_x(x)$ is uniformly distributed.
12. Explain Normal distribution, Binomial distribution and Poisson distribution in the exponential family form.

Course Outcome 4(CO4):

1. Find the extrema of $f(x, y) = x$ subject to $g(x, y) = x^2 + 2y^2 = 3$.
2. Maximize the function $f(x, y, z) = xy + yz + xz$ on the unit sphere $g(x, y, z) = x^2 + y^2 + z^2 = 1$.
3. Provide necessary and suffcient conditions under which a quadratic optimization problem be written as a linear least squares problem.
4. Consider the univariate function $f(x) = x^3 + 6x^2 - 3x - 5$. Find its stationary points and indicate whether they are maximum, minimum, or saddle points.
5. Consider the update equation for stochastic gradient descent. Write down the update when we use a mini-batch size of one.

6. Consider the function

$$f(x) = (x_1 - x_2)^2 + \frac{1}{1 + x_1^2 + x_2^2}.$$

   i. Is ***f(x)*** a convex function? Justify your answer.

   ii. Is (1 , -1) a local/global minimum? Justify your answer.

7. Is the function ***f(x, y) = 2x² + y² + 6xy - x + 3y - 7*** convex, concave, or neither? Justify your answer.

8. Consider the following convex optimization problem

$$\text{minimize } \frac{x^2}{2} + x + 4y^2 - 2y$$

   Subject to the constraint ***x + y >= 4, x, y >= 1***.

   Derive an explicit form of the Lagrangian dual problem.

9. Solve the following LP problem with the simplex method.

$$max\ 5x_1 + 6x_2 + 9x_3 + 8x_4$$

   subject to the constraints

$$\begin{aligned} x_1 + 2x_2 + 3x_3 + x_4 &\leq 5 \\ x_1 + x_2 + 2x_3 + 3x_4 &\leq 3 \\ x_1, x_2, x_3, x_4 &\geq 0 \end{aligned}$$

Course Outcome 5 (CO5):

1. What is a loss function? Give examples.
2. What are training/validation/test sets? What is cross-validation? Name one or two examples of cross-validation methods.
3. Explain generalization, overfitting, model selection, kernel trick, Bayesian learning

4. Distinguish between Maximum Likelihood Estimation (MLE) and Maximum A Posteriori Estimation (MAP)?
5. What is the link between structural risk minimization and regularization?
6. What is a kernel? What is a dot product? Give examples of kernels that are valid dot products.
7. What is ridge regression? How can one train a ridge regression linear model?
8. What is Principal Component Analysis (PCA)? Which eigen value indicates the direction of largest variance? In what sense is the representation obtained from a projection onto the eigen directions corresponding the the largest eigen values optimal for data reconstruction?
9. Suppose that you have a linear support vector machine (SVM) binary classifier. Consider a point that is currently classified correctly, and is far away from the decision boundary. If you remove the point from the training set, and re-train the classifier, will the decision boundary change or stay the same? Explain your answer in one sentence.
10. Suppose you have ***n*** independent and identically distributed (i.i.d) sample data points $x_1, \ldots, x_n$. These data points come from a distribution where the probability of a given datapoint ***x*** is

$$P(x) = \frac{1}{\theta} e^{-\frac{1}{\theta}x}.$$

    Prove that the MLE estimate of parameter is the sample mean.

11. Suppose the data set $y_1,\ldots,y_n$ is a drawn from a random sample consisting of i.i.d. discrete uniform distributions with range 1 to ***N***. Find the maximum likelihood estimate of ***N***.
12. Ram has two coins: one fair coin and one biased coin which lands heads with probability 3/4. He picks one coin at random (50-50) and flips it repeatedly until he gets a tails. Given that he observes 3 heads before the first tails, find the posterior probability that he picked each coin.
    i. What are the prior and posterior odds for the fair coin?
    ii. What are the prior and posterior predictive probabilities of heads on the next flip? Here prior predictive means prior to considering the data of the first four flips.

Model Question paper

QP Code : **Total Pages: 4**

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

IV SEMESTER B.TECH (HONOURS) DEGREE EXAMINATION, MONTH and YEAR

Course Code: CST 294

Course Name: COMPUTATIONAL FUNDAMENTALS FOR MACHINE LEARNING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Show that with the usual operation of scalar multiplication but with addition on reals given by $x \# y = 2(x + y)$ is not a vector space.

2 Find the eigenvalues of the following matrix in terms of k. Can you find an eigenvector corresponding to each of the eigenvalues?

$$\begin{bmatrix} 1 & k \\ 2 & 1 \end{bmatrix}$$

3 Let $f(x, y, z) = xye^r$, where $r = x^2+z^2-5$. Calculate the gradient of f at the point **(1, 3, -2)**.

4 Compute the Taylor polynomials $T_n, n = 0, \ldots, 5$ of $f(x) = \sin(x) + \cos(x)$ at $x_0 = 0$.

5 Let X be a continuous random variable with probability density function on $0 <= x <= 1$ defined by $f(x) = 3x^2$. Find the pdf of $Y = X^2$.

6 Show that if two events A and B are independent, then A and B' are independent.

7 Explain the principle of the gradient descent algorithm.

8 Briey explain the difference between (batch) gradient descent and stochastic gradient descent. Give an example of when you might prefer one over the other.

9 What is the empirical risk? What is “empirical risk minimization”?

10 Explain the concept of a Kernel function in Support Vector Machines. Why are kernels so useful? What properties a kernel should posses to be used in an SVM?

PART B

Answer any one Question from each module. Each question carries 14 Marks

11 a) i. Find all solutions to the system of linear equations (6)

$$-4x + 5z = -2$$
$$-3x - 3y + 5z = 3$$
$$-x + 2y + 2z = -1$$

ii. Prove that all vectors orthogonal to $[2, -3, 1]^T$ forms a subspace W of R^3. What is $dim\ (W)$ and why?

b) Use the Gramm-Schmidt process to find an orthogonal basis for the column space of the following matrix (8)

$$\begin{bmatrix} 2 & 1 & 0 \\ 1 & -1 & 1 \\ 0 & 3 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

OR

12 a) i. Let L be the line through the origin in R^2 that is parallel to the vector $[3, 4]^T$. Find the standard matrix of the orthogonal projection onto L. Also find the point on L which is closest to the point $(7, 1)$ and find the point on L which is closest to the point $(-3, 5)$. (6)

ii. Find the rank-1 approximation of

$$\begin{bmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{bmatrix}$$

b) i. Find an orthonormal basis of R^3 consisting of eigenvectors for the following matrix (8)

$$\begin{bmatrix} 1 & 0 & -2 \\ 0 & 5 & 0 \\ -2 & 0 & 4 \end{bmatrix}$$

ii. Find a 3 × 3 orthogonal matrix S and a 3 × 3 diagonal matrix D such that $A = SDS^T$.

13 a) A skier is on a mountain with equation $z = 100 - 0.4x^2 - 0.3y^2$, where z denotes height. (8)

i. The skier is located at the point with xy-coordinates **(1 , 1)**, and wants to ski downhill along the steepest possible path. In which direction (indicated by a vector **(a , b)** in the xy-plane) should the skier begin skiing.

ii. The skier begins skiing in the direction given by the xy-vector **(a , b)** you found in part (i), so the skier heads in a direction in space given by the vector **(a , b , c)**. Find the value of **c**.

b) Find the linear approximation to the function $f(x,y) = 2 - \sin(-x - 3y)$ at the point $(0 , \pi)$, and then use your answer to estimate $f(0.001 , \pi)$. (6)

OR

14 a) Let ***g*** be the function given by (8)

$$g(x,y) = \begin{cases} \dfrac{x^2 y}{x^2+y^2} & \text{if } (x,y) \neq (0,0); \\ 0 & \text{if } (x,y) = (0,0). \end{cases}$$

i. Calculate the partial derivatives of ***g*** at **(0 , 0)**.

ii. Show that ***g*** is not differentiable at **(0 , 0)**.

b) Find the second order Taylor series expansion for $f(x,y) = e^{-(x^2+y^2)} \cos(xy)$ about **(0 , 0)**. (6)

15 a) There are two bags. The first bag contains four mangos and two apples; the second bag contains four mangos and four apples. We also have a biased coin, which shows "heads" with probability 0.6 and "tails" with probability 0.4. If the coin shows "heads". we pick a fruit at random from bag 1; otherwise we pick a fruit at random from bag 2. Your friend flips the coin (you cannot see the result), picks a fruit at random from the corresponding bag, and presents you a mango. (6)

What is the probability that the mango was picked from bag 2?

b) Suppose that one has written a computer program that sometimes compiles and sometimes not (code does not change). You decide to model the apparent stochasticity (success vs. no success) ***x*** of the compiler using a Bernoulli distribution with parameter μ: (8)

$$p(x \mid \mu) = \mu^x (1-\mu)^{1-x}, \quad x \in \{0,1\}$$

Choose a conjugate prior for the Bernoulli likelihood and compute the posterior distribution $p(\mu \mid x_1, \ldots, x_N)$.

OR

16 a) Consider a mixture of two Gaussian distributions (8)

$$0.4\mathcal{N}\left(\begin{bmatrix}10\\2\end{bmatrix}, \begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}\right) + 0.6\mathcal{N}\left(\begin{bmatrix}0\\0\end{bmatrix}, \begin{bmatrix}8.4 & 2.0\\2.0 & 1.7\end{bmatrix}\right)$$

i. Compute the marginal distributions for each dimension.

ii. Compute the mean, mode and median for each marginal distribution.

iii. Compute the mean and mode for the two-dimensional distribution.

b) Express the Binomial distribution as an exponential family distribution. Also express the Beta distribution is an exponential family distribution. Show that the product of the Beta and the Binomial distribution is also a member of the exponential family. (6)

17 a) Find the extrema of $f(x,y,z) = x - y + z$ subject to $g(x,y,z) = x^2 + y^2 + z^2 = 2$. (8)

b) Let

$$P = \begin{bmatrix} 13 & 12 & -2 \\ 12 & 17 & 6 \\ -2 & 6 & 12 \end{bmatrix}, \; q = \begin{bmatrix} -22.0 \\ -14.5 \\ 13.0 \end{bmatrix}, \; \text{and} \; \; r = 1.$$

Show that $x^* = (1 , 1/2 , -1)$ is optimal for the optimization problem

$$\begin{array}{ll} \min & \frac{1}{2}x^T P x + q^T x + r \\ \text{s.t.} & -1 \leq x_i \leq 1, \; i = 1, 2, 3. \end{array}$$

(6)

OR

18 a) Derive the gradient descent training rule assuming that the target function is represented as $o_d = w_0 + w_1x_1 + \ldots + w_nx_n$. Define explicitly the cost/ error function E, assuming that a set of training examples D is provided, where each training example $d \in D$ is associated with the target output t_d. (8)

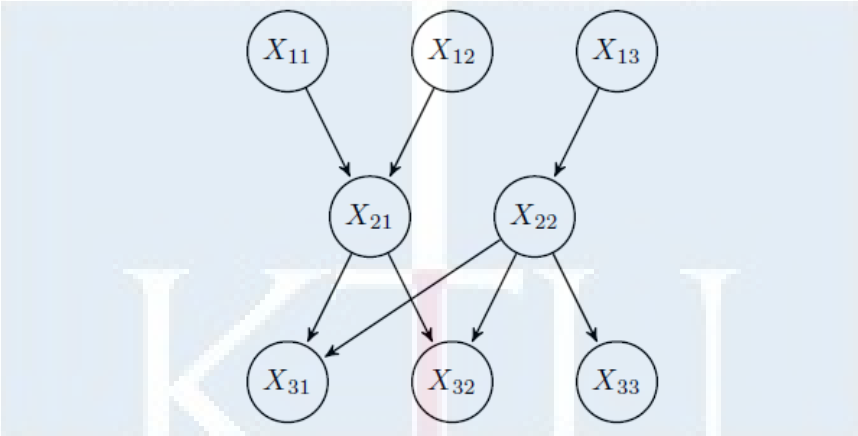
b) Find the maximum value of $f(x,y,z) = xyz$ given that $g(x,y,z) = x + y + z = 3$ and $x,y,z >= 0$. (6)

19 a) Consider the following probability distribution (7)

$$P_\theta(x) = 2\theta x e^{-\theta x^2}$$

where θ is a parameter and x is a positive real number. Suppose you get m i.i.d. samples x_i drawn from this distribution. Compute the maximum likelihood estimator for θ based on these samples.

b) Consider the following Bayesian network with boolean variables. (7)



i. List variable(s) conditionally independent of X_{33} given X_{11} and X_{12}

ii. List variable(s) conditionally independent of X_{33} and X_{22}

iii. Write the joint probability $P(X_{11}, X_{12}, X_{13}, X_{21}, X_{22}, X_{31}, X_{32}, X_{33})$ factored according to the Bayes net. How many parameters are necessary to define the conditional probability distributions for this Bayesian network?

iv. Write an expression for $P(X_{13} = 0, X_{22} = 1, X_{33} = 0)$ in terms of the conditional probability distributions given in your answer to part (iii). Justify your answer.

OR

20 a) Consider the following one dimensional training data set, 'x' denotes negative examples and 'o' positive examples. The exact data points and their labels are given in the table below. Suppose a SVM is used to classify this data. (6)

x	1	1.5	2.5	3	4	4.5	5	5.6
y	-1	-1	-1	1	1	1	1	1

i. Indicate which are the support vectors and mark the decision boundary.

ii. Give the value of the cost function and the model parameter after training.

b) Suppose that we are fitting a Gaussian mixture model for data items consisting of a single real value, x, using $K = 2$ components. We have $N = 5$ training cases, in which the values of x are as **5, 15, 25, 30, 40**. Using the EM algorithm to find the maximum likeihood estimates for the model parameters, what are the mixing proportions for the two components, π_1 and π_2, and the means for the two components, μ_1 and μ_2. The standard deviations for the two components are fixed at 10. (8)

Suppose that at some point in the EM algorithm, the **E** step found that the responsibilities of the two components for the five data items were as follows:

r_{i1}	r_{i2}
0.2	0.8
0.2	0.8
0.8	0.2
0.9	0.1
0.9	0.1

What values for the parameters π_1, π_2 , μ_1, and μ_2 will be found in the next **M** step of the algorithm?

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Teaching Plan		
No	**Topic**	**No. of Lectures (45)**
1	**Module-I (LINEAR ALGEBRA)**	**8**
1.	Systems of Linear Equations – Matrices, Solving Systems of Linear Equations. Vector Spaces - Linear Independence.	1
2.	Vector Spaces - Basis and Rank	1
3.	Linear Mappings	1
4.	Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement	1
5.	Orthogonal Projections, Matrix Decompositions, Determinant and Trace.	1
6.	Eigenvalues and Eigenvectors	1
7.	Cholesky Decomposition, Eigen decomposition and Diagonalization	1
8.	Singular Value Decomposition - Matrix Approximation	1
	Module-II (VECTOR CALCULUS)	**6**
1	Differentiation of Univariate Functions, Partial Differentiation and Gradients	1
2	Gradients of Vector Valued Functions, Gradients of Matrices	1
3	Useful Identities for Computing Gradients	1
4	Backpropagation and Automatic Differentiation	1
5	Higher Order Derivatives	1
6	Linearization and Multivariate Taylor Series	1
3	**Module-III (Probability and Distributions)**	**10**
1	Construction of a Probability Space - Discrete and Continuous Probabilities (Lecture 1)	1

2	Construction of a Probability Space - Discrete and Continuous Probabilities (Lecture 2)	1
3	Sum Rule, Product Rule	1
4	Bayes' Theorem	1
5	Summary Statistics and Independence	1
6	Important probability Distributions (Lecture 1)	1
7	Important probability Distributions (Lecture 2)	1
8	Conjugacy and the Exponential Family (Lecture 1)	1
9	Conjugacy and the Exponential Family (Lecture 2)	1
10	Change of Variables/Inverse Transform	1
4	**Module-IV (Optimization)**	**7**
1	Optimization Using Gradient Descent.	1
2	Gradient Descent With Momentum, Stochastic Gradient Descent	1
3	Constrained Optimization and Lagrange Multipliers (Lecture 1)	1
4	Constrained Optimization and Lagrange Multipliers (Lecture 2)	1
5	Convex Optimization	1
6.	Linear Programming	1
7.	Quadratic Programming	1
5	**Module-V (CENTRAL MACHINE LEARNING PROBLEMS)**	**14**
1.	Data and Learning models - Empirical Risk Minimization,	1
2.	Parameter Estimation	1
3.	Directed Graphical Models	1
4.	Linear Regression	1
5.	Bayesian Linear Regression	1
6.	Maximum Likelihood as Orthogonal Projection	1
7.	Dimensionality Reduction with Principal Component Analysis - Maximum Variance Perspective, Projection Perspective.	1
8.	Eigenvector Computation and Low Rank Approximations	1
9.	Density Estimation with Gaussian Mixture Models	1

10.	Parameter Learning via Maximum Likelihood	1
11.	EM Algorithm	1
12.	Classification with Support Vector Machines - Separating Hyperplanes	1
13.	Primal Support Vector Machines, Dual Support Vector Machines	1
14.	Kernels	1
*Assignments may include applications of the above theory. With respect to module V, programming assignments may be given.		

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
KTU
Estd. 2014

AIT296	ADVANCED TOPICS IN COMPUTER GRAPHICS	CATEGORY	L	T	P	CREDITS
		VAC	3	1	0	4

Preamble: This course helps the learners to make awareness about strong theoretical concept in computer graphics. It covers the three-dimensional environment representation in a computer, transformation of 2D/3D objects, basic mathematical techniques and algorithms used to build useful applications. This course enables the learners to develop the ability to create image processing frameworks for different domains and develops algorithms for emerging display technologies.

Prerequisite: A sound knowledge of Mathematics and concepts of any programming language.

Course Outcomes: After the completion of the course the student will be able to

CO#	CO
CO1	Describe the working principles of graphics devices**(Cognitive Knowledge level: Understand)**
CO2	Illustrate line drawing, circle drawing and polygon filling algorithms**(Cognitive Knowledge level: Apply)**
CO3	Demonstrate geometric representations and transformations on 2D & 3D objects. **(Cognitive Knowledge level: Apply)**
CO4	Demonstrate the working of various clipping algorithms and projection algorithms. **(Cognitive Knowledge level: Apply)**
CO5	Summarize visible surface detection methods**(Cognitive Knowledge level: Understand)**
CO6	Explain the concept of realism in a scene and its performance preservation**(Cognitive Knowledge level: Understand)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓	✓	✓	✓							✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓											✓
CO6	✓	✓										✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks (%)
	Test 1 (%)	Test 2 (%)	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3

Continuous Internal Evaluation Pattern:

Attendance **10 marks**

Continuous Assessment Tests (Average of SeriesTests1& 2) **25 marks**

Continuous Assessment Assignment **15 marks**

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. The first series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing the remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 full questions from each module of which student should answer any one full question. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

Module – 1(Line and Circle drawing algorithms)

Basics of Computer Graphics and its applications. Video Display devices - Refresh Cathode Ray Tubes, Random Scan Displays and systems, Raster scan displays and systems, Color CRT displays, Flat panel display and its categories. Line drawing algorithms - DDA, Bresenham's algorithm. Circle drawing algorithms - Midpoint Circle generation algorithm, Bresenham's algorithm.

Module - 2(Filled Area Primitives and Two dimensional transformations)

Filled Area Primitives- Scan line polygon filling, Boundary filling and flood filling. Two dimensional transformations-Translation, Rotation, Scaling, Reflection and Shearing, Composite transformations, Matrix representations and homogeneous coordinates.

Module - 3 (Clipping and 3D transformations)

Window to viewport transformation. Cohen Sutherland and Midpoint subdivision line clipping algorithms, Sutherland Hodgeman and Weiler Atherton Polygon clipping algorithms. Three dimensional viewing pipeline. Basic 3D transformations.

Module - 4 (Projections and Visible Surface detection)

Projections- Parallel and Perspective projections. Visible surface detection algorithms- Back face detection, Depth buffer algorithm, Scan line algorithm, A buffer algorithm

Module - 5 (Realism and performance)

Realism - Illumination Shading, Shadows, Texture mapping, Bump mapping, Environment mapping, Transparency, Accumulation Buffer, Back face Culling, Visibility Culling.

Text Books

1. Donald Hearn and M. Pauline Baker, Computer Graphics, PHI, 2e, 1996
2. Aditi Majumder and M.Gopi , Introduction to VISUAL COMPUTING Core Concepts in Computer Vision, Graphics, and Image Processing, 2018

References

1) William M. Newman and Robert F. Sproull, Principles of Interactive Computer Graphics. McGraw Hill, 2001
2) Zhigang Xiang and Roy Plastock, Computer Graphics (Schaum's outline Series), McGraw Hill, 2019.
3) David F. Rogers , Procedural Elements for Computer Graphics, Tata McGraw Hill,2001.
4) Donald Hearn, M. Pauline Baker and Warren Carithers, Computer Graphics with OpenGL, PHI, 4e, 2013

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Compare the working principle of raster scan systems and random scan systems.
2. How much time is spent scanning across each row of pixels during screen refresh on a raster system with resolution of 1280*1024 and a refresh rate of 60 frames per second?

Course Outcome 2 (CO2):

1. Rasterize the line with end points accepted from the user(2,3) and (5,8) using Bresenham's line drawing algorithm and implement it using any appropriate programming language. (Assignment)
2. Illustrate how the 4-connected area filling approach differs from 8- connected area filling in boundary filling algorithm and implement it using any appropriate programming language.(Assignment)

Course Outcome 3 (CO3):

1. Rotate a triangle ABC 45 degree counter clockwise about the pivot point (10,3) , where the position vector of the coordinate ABC is given as A(4,1), B(5,2) and C(4,3).
2. Implement the above transformation using any appropriate programming language with user inputs. (Assignment)

Course Outcome 4 (CO4):

1. Given a clipping window A(20,20), B(60,20), C(60,40) and D(20,40). Using Cohen Sutherland algorithm, find the visible portion of the line segment joining the points P(40,80) and Q(120,30).
2. Implement Cohen Sutherland clipping algorithm using any appropriate programming language with user inputs. (Assignment)

Course Outcome 5 (CO5):

1. Explain scan line algorithm for detecting visible surfaces in an object.

Course Outcome 6 (CO6):

1. You are rendering a black and white checkered tiled floor using a single texture mapped polygon. The view is simulating a person standing on the floor and looking at a point far away from him on the floor. (1)Artifacts at the distant end of the floor can be seen. How would you remove these artifacts? (2) How can you explain why this method works using the sampling theorem?
2. You are seeing an object which is either texture mapped, bump mapped or displacement mapped but you don't know which one. However, you have the liberty to move the light and the viewpoint of an object and see it from different angles and for different positions of the light. How will you figure out which technique was used?

Model Question Paper

QP CODE:

Reg No: _____

Name: _____ **PAGES : 4**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE (HONOURS) EXAMINATION, MONTH & YEAR

Course Code:AIT296

Course Name: Advanced Topics in Computer Graphics

Max. Marks : 100 **Duration: 3 Hours**

PART A

Answer All Questions. Each Question Carries 3 Marks

1. Consider a raster system with a resolution of 1024*1024. Compute the size of the raster needed to store 4 bits per pixel? How much storage is needed if 8 bits per pixel are to be stored?
2. How 8-way symmetry of circle can be used for writing circle drawing algorithms? Write the symmetric points if (x, y) is a point on the circle with centre at origin.
3. Show that two successive reflections about either of the coordinate axes is equivalent to a single rotation about the coordinate origin.
4. Determine a sequence of basic transformations that are equivalent to the x-direction shearing matrix.

5. Find the window to viewport normalization transformation with window lower left corner at (1,1) and upper right corner at (2,6).

6. How does Cohen Sutherland algorithm determine whether a line is visible, invisible or a candidate for clipping based on the region codes assigned to the end points of the line?

7. Define the terms (i) Centre of projection (ii) Principal vanishing point

8. Differentiate between the object space and image space method for the hidden surface removal of an image.

9. Describe the steps used to convert the normal map to bump mapping.

10. One artifact of Gouraud shading is that it can miss specular highlights in the interior of the triangles. How can this be explained as an aliasing artifact? **(10x3=30)**

Part B

(Answer any one question from each module. Each question carries 14 Marks)

11. (a) Derive the initial decision parameter of Bresenham's line drawing algorithm and rasterize a line with endpoints (2,2) and (10,10). **(8)**

(b) Draw the architecture of raster scan display systems and explain its working principle **(6)**

OR

12. (a) Explain the working principle of a Refresh CRT monitor with suitable diagrams. **(7)**

(b) Write Midpoint circle drawing algorithm and plot a circle with radius=20 and center (50,30) using the algorithm. **(7)**

13. (a) Differentiate between boundary fill and flood fill algorithms. **(5)**

(b) Reflect a triangle ABC about the line 3x-4y+8=0, where the position vector of the coordinate ABC is given as A(4,1), B(5,2) and C(4,3). **(9)**

OR

14. (a) A diamond shaped polygon is located at P(-1,0), Q(0,-2), R(1,0) and S(0,2). Find the transformation matrix which would rotate the triangle by 90 degree counter clockwise about the point Q. Using the transformation matrix, find the coordinates of the rotated polygon. **(7)**

(b) Illustrate the working principle of scan line polygon filling algorithm **(7)**

15. (a) Illustrate Weiler – Atherton polygon clipping algorithm. **(6)**

(b) Explain Cohen-Sutherland line clipping algorithm. Use the algorithm to clip line P1 (70, 20) and P2(100,10) against a window lower left hand corner (50,10) and upper right hand corner (80,40). **(8)**

OR

16. (a) Describe the steps required for a general 3D rotation if the rotation axis is not parallel to any one of the principal axis. The rotation axis is defined by the points P1(x1,y1,z1) and P2(x2,y2,z2). Give its composite matrix representation **(6)**

(b) Describe Sutherland Hodgeman polygon clipping algorithm and list out its limitations **(8)**

17. (a) Explain how visible surfaces can be detected using depth buffer algorithm. **(7)**

(b) Define parallel projection. Describe orthographic and oblique parallel projection. **(7)**

OR

18. (a) Illustrate the scan line method used in visible surface detection. **(7)**

(b) Explain the steps involved in performing perspective projections **(7)**

19. (a) Specify any three shading algorithms used in interactive graphics. **(6)**

(b) Explain the procedure of texture to object space mapping. **(8)**

OR

20. (a) Explain the mapping scheme in which the effects of small bumps on the surface of an object can be simulate without changing the number of primitives **(8)**

(b) Describe about object to screen space mapping. **(6)**

TEACHING PLAN

No	Contents	No of Lecture Hrs
Module – 1 (Line and Circle drawing algorithms) (10 hrs)		
1.1	Basics of Computer Graphics and applications	1
1.2	Refresh Cathode Ray Tubes	1
1.3	Random and Raster Scan Displays and systems,	1
1.4	Color CRT displays	1
1.5	Flat panel display and its categories.	1
1.6	DDA Line drawing Algorithm	1
1.7	Bresenham's line drawing algorithm	1
1.8	Midpoint Circle generation algorithm	1
1.9	Bresenham's Circle generation algorithm	1
1.10	Illustration of line and circle drawing algorithms	1
Module - 2 (Filled Area Primitives and Two dimensional transformations) (9 hrs)		
2.1	Scan line polygon filling	1
2.2	Boundary filling and flood filling	1
2.3	Basic 2D transformations-Translation	1
2.4	Basic 2D transformations- Rotation	1
2.5	Basic 2D transformations- Scaling	1
2.6	Reflection and Shearing	1
2.7	Illustration of Basic 2D Transformations	1
2.8	Composite transformations	1
2.9	Matrix representations and homogeneous coordinates	1
Module - 3 (Clipping and 3D transformations) (8 hrs)		
3.1	Window to viewport transformation	1
3.2	Cohen Sutherland Line clipping algorithm	1
3.3	Midpoint subdivision Line clipping algorithm	1
3.4	Sutherland Hodgeman Polygon clipping algorithm	1
3.5	Weiler Atherton Polygon clipping algorithm	1
3.6	Three dimensional viewing pipeline	1

3.7	Basic 3D transformation-Translation and scaling	1
3.8	Basic 3D transformation-Rotation	1
Module - 4 (Projections and Visible Surface detection) (7 hrs)		
4.1	Projections-Parallel projections	1
4.2	Projections- Perspective projections	1
4.3	Illustration of projection methods	1
4.4	Visible surface detection algorithms- Back face detection	1
4.5	Depth buffer algorithm	1
4.6	Scan line visible surface detection algorithm	1
4.7	*A buffer* algorithm	1
Module - 5 (Realism and performance)(10 hrs)		
5.1	Illumination	1
5.2	Shading and Shadows	1
5.3	Texture mapping-Texture to object space mapping	1
5.4	Texture mapping-Object to screen space mapping and Mip Mapping	1
5.5	Bump mapping	1
5.6	Bump mapping-Illustration	1
5.7	Environment mapping and Transparency	1
5.8	Accumulation Buffer and Back face Culling	1
5.9	Visibility Culling	1
5.10	Visibility Culling	1

COMMON COURSES S3 & S4

SEMESTER -3

CODE		CATEGORY	L	T	P	CREDIT
MCN201	SUSTAINABLE ENGINEERING		2	0	0	NIL

Preamble: Objective of this course is to inculcate in students an awareness of environmental issues and the global initiatives towards attaining sustainability. The student should realize the potential of technology in bringing in sustainable practices.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the relevance and the concept of sustainability and the global initiatives in this direction
CO 2	Explain the different types of environmental pollution problems and their sustainable solutions
CO 3	Discuss the environmental regulations and standards
CO 4	Outline the concepts related to conventional and non-conventional energy
CO 5	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	3					2
CO 2						2	3					2
CO 3						2	3					2
CO 4						2	3					2
CO 5						2	3					2

Assessment Pattern

Mark distribution

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	40
Understand	20	20	40
Apply	10	10	20
Analyse			
Evaluate			
Create			

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Course Level Assessment Questions

Course Outcome 1 (CO1): Understand the relevance and the concept of sustainability and the global initiatives in this direction

1. Explain with an example a technology that has contributed positively to sustainable development.
2. Write a note on Millennium Development Goals.

Course Outcome 2 (CO2): Explain the different types of environmental pollution problems and their sustainable solutions

1. Explain the 3R concept in solid waste management?
2. Write a note on any one environmental pollution problem and suggest a sustainable solution.
3. In the absence of green house effect the surface temperature of earth would not have been suitable for survival of life on earth. Comment on this statement.

Course Outcome 3(CO3): Discuss the environmental regulations and standards

1. Illustrate Life Cycle Analysis with an example of your choice.
2. "Nature is the most successful designer and the most brilliant engineer that has ever evolved". Discuss.

Course Outcome 4 (CO4): Outline the concepts related to conventional and non-conventional energy

1. Suggest a sustainable system to generate hot water in a residential building in tropical climate.
2. Enumerate the impacts of biomass energy on the environment.

Course Outcome 5 (CO5): Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

1. Suggest suitable measures to make the conveyance facilities used by your institution sustainable.

Model Question paper

Part A

(Answer all questions. Each question carries 3 marks each)

1. Define sustainable development.
2. Write a short note on Millennium Development Goals.
3. Describe carbon credit.
4. Give an account of climate change and its effect on environment.
5. Describe biomimicry? Give two examples.
6. Explain the basic concept of Life Cycle Assessment.
7. Name three renewable energy sources.

8. Mention some of the disadvantages of wind energy.
9. Enlist some of the features of sustainable habitat.
10. Explain green engineering.

Part B

(Answer one question from each module. Each question carries 14 marks)

11. Discuss the evolution of the concept of sustainability. Comment on its relevance in the modern world.

OR

12. Explain Clean Development Mechanism.
13. Explain the common sources of water pollution and its harmful effects.

OR

14. Give an account of solid waste management in cities.
15. Explain the different steps involved in the conduct of Environmental Impact Assessment.

OR

16. Suggest some methods to create public awareness on environmental issues.
17. Comment on the statement, "Almost all energy that man uses comes from the Sun".

OR

18. Write notes on:
    a. Land degradation due to water logging.
    b. Over exploitation of water.
19. Discuss the elements related to sustainable urbanisation.

OR

20. Discuss any three methods by which you can increase energy efficiency in buildings.

Syllabus

Sustainability- need and concept, technology and sustainable development-Natural resources and their pollution, Carbon credits, Zero waste concept. Life Cycle Analysis, Environmental Impact Assessment studies, Sustainable habitat, Green buildings, green materials, Energy, Conventional and renewable sources, Sustainable urbanization, Industrial Ecology.

Module 1

Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).

Module 2

Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.

Module 3

Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.

Module 4

Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.

Module 5

Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.

Reference Books

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
3. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
5. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
6. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
7. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
8. Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Sustainability	
1.1	Introduction, concept, evolution of the concept	1
1.2	Social, environmental and economic sustainability concepts	1
1.3	Sustainable development, Nexus between Technology and Sustainable development	1
1.4	Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)	1
1.5	Clean Development Mechanism (CDM)	1
2	Environmental Pollution	
2.1	Air Pollution and its effects	1
2.2	Water pollution and its sources	1
2.3	Zero waste concept and 3 R concepts in solid waste management	1
2.4	Greenhouse effect, Global warming, Climate change, Ozone layer depletion	1
2.5	Carbon credits, carbon trading and carbon foot print.	1
2.6	Legal provisions for environmental protection.	1
3	Environmental management standards	
3.1	Environmental management standards	1
3.2	ISO 14001:2015 frame work and benefits	1
3.3	Scope and Goal of Life Cycle Analysis (LCA)	1
3.4	Circular economy, Bio-mimicking	1
3.5	Environment Impact Assessment (EIA)	1
3.6	Industrial Ecology, Industrial Symbiosis	1
4	Resources and its utilisation	
4.1	Basic concepts of Conventional and non-conventional energy	1
4.2	General idea about solar energy, Fuel cells	1
4.3	Wind energy, Small hydro plants, bio-fuels	1
4.4	Energy derived from oceans and Geothermal energy	1
5	Sustainability Practices	
5.1	Basic concept of sustainable habitat	1
5.2	Methods for increasing energy efficiency of buildings	1
5.3	Green Engineering	1
5.4	Sustainable Urbanisation, Sustainable cities, Sustainable transport	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
EST 200	DESIGN AND ENGINEERING		2	0	0	2

Preamble:

The purpose of this course is to

i) introduce the undergraduate engineering studentsthe fundamental principles of design engineering,

ii) make them understand the steps involved in the design process and

iii) familiarize them with the basic tools used and approaches in design.

Students are expected to apply design thinking in learning as well as while practicing engineering, which is very important and relevant for today. Case studies from various practical situations will help the students realize that design is not only concerned about the function but also many other factors like customer requirements, economics, reliability, etc. along with a variety of life cycle issues.

The course will help students to consider aesthetics, ergonomics and sustainability factors in designs and also to practice professional ethics while designing.

Prerequisite:

Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.

Course Outcomes:

After the completion of the course the student will be able to

CO 1	Explain the different concepts and principles involved in design engineering.
CO 2	Apply design thinking while learning and practicing engineering.
CO 3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1					1			1		
CO 2		2				1		1				2
CO 3			2			1	1		2	2		1

Assessment Pattern

Continuous Internal Evaluation (CIE) Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination (ESE) Pattern: There will be two parts; Part A and Part B.
Part A : 30 marks
part B : 70 marks
Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions.
Part B contains 2 case study questions from each module of which student should answer any one. Each question carry 14 marks and can have maximum 2 sub questions.

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	10	10	20
Apply	35	35	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1): Appreciate the different concepts and principles involved in design engineering.

1. State how engineering design is different from other kinds of design

2. List the different stages in a design process.

3. Describedesign thinking.

4. State the function of prototyping and proofing in engineering design.

5. Write notes on the following concepts in connection with design engineering 1) Modular Design, 2) Life Cycle Design , 3) Value Engineering, 4) Concurrent Engineering, and 5) Reverse Engineering

6. State design rights.

Course Outcome 2 (CO2) Apply design thinking while learning and practicing engineering.

1. Construct the iterative process for design thinking in developing simple products like a pen, umbrella, bag, etc.

2. Show with an example how divergent-convergent thinking helps in generating alternative designs and then how to narrow down to the best design.

3. Describe how a problem-based learning helps in creating better design engineering solutions.

4. Discuss as an engineer, how ethics play a decisive role in your designs

Course Outcome 3(CO3): Develop innovative, reliable, sustainable and economically viable designs incorporating different segments of knowledge in engineering.

1. Illustratethe development of any simple product by passing through the different stages of design process

2. Show thegraphical design communication with the help of detailed 2D or 3D drawings for any simple product.

3. Describe how to develop new designs for simple products through bio-mimicry.

Model Question paper

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: EST 200

Course Name: DESIGN AND ENGINEERING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each question carries 3 marks

Use only hand sketches

(1) Write aboutthe basic design process.

(2) Describe how to finalize the design objectives.

(3) State the role of divergent-convergent questioning in design thinking.

(4) Discuss how to perform design thinking in a team managing the conflicts.

(5) Show how engineering sketches and drawings convey designs.

(6) Explain the role of mathematics and physics in design engineering process.

(7) Distinguish between project-based learning and problem-based learning in design engineering.

(8) Describe how concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?

(9) Show how designs are varied based on the aspects of production methods, life span, reliability and environment?

(10) Explain how economics influence the engineering designs?

(10x3 marks =30 marks)

Part B

Answer any ONE question from each module. Each question carry 14 marks

Module 1

(11) Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.

or

(12) Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Module 2

(13) Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

or

(14) Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Module 3

(15) Graphically communicate the design of a thermo flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.

or

(16) Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.

Module 4

(17) Show the development of a nature inspired design for a solar poweredbus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.

or

(18) Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

Module 5

(19) Examine the changes in the design of a foot wear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.

or

(20) Describe the how to estimate the cost of a particular design using ANY of the following: i) a website, ii) the layout of a plant, iii) the elevation of a building, iv) anelectrical or electronic system or device and v) a car.

Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

(5x14 marks =70 marks)

Syllabus

Module 1

Design Process:- Introduction to Design and Engineering Design, Defining a Design Process-:Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.

Module 2

Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.

Module 3

Design Communication (Languages of Engineering Design):-Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.

Module 4

Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design.Modular Design and Life Cycle Design Approaches. Application of Bio-mimicry,Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.

Module 5

Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design

Text Books

1) YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285,

2) Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

Reference Books

1. Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.
2. Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5
3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
4. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1: Design Process**	
1.1	Introduction to Design and Engineering Design. *What does it mean to design something? How Is engineering design different from other kinds of design? Where and when do engineers design? What are the basic vocabularyin engineering design? How to learn and do engineering design.*	1
1.2	*Defining a Design Process*-: Detailing Customer Requirements. *How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?*	1
1.3	*Defining a Design Process*-: Setting Design Objectives, Identifying Constraints, Establishing Functions. *How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?*	1
1.4	*Defining a Design Process*-: Generating Design Alternatives and Choosing a Design. *How to generate or create feasible design alternatives? How to identify the "best possible design"?*	1
1.5	Case Studies:- Stages of Design Process. *Conduct exercises for designing simple products going through the different stages of design process.*	1
2	**Module 2: Design Thinking Approach**	
2.1	Introduction to Design Thinking *How does the design thinking approach help engineers in creating innovative and efficient designs?*	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. *How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?*	1
2.3	Design Thinking as Divergent-Convergent Questioning. *Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'.*	1
2.4	Design Thinking in a Team Environment. *How to perform design thinking as a team managing the conflicts ?*	1
2.5	Case Studies: Design Thinking Approach. *Conduct exercises using the design thinking approach for*	1

	designing any simple products within a limited time and budget	
3	**Module 3: Design Communication (Languages of Engineering Design)**	
3.1	Communicating Designs Graphically. *How do engineering sketches and drawings convey designs?*	1
3.2	Communicating Designs Orally and in Writing. *How can a design be communicated through oral presentation or technical reports efficiently?*	1
	First Series Examination	
3.3	Mathematical Modelling in Design. *How do mathematics and physics become a part of the design process?*	1
3.4	Prototyping and Proofing the Design. *How to predict whether the design will function well or not?*	1
3.5	Case Studies: Communicating Designs Graphically. *Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.*	1
4	**Module 4: Design Engineering Concepts**	
4.1	Project-based Learning and Problem-based Learning in Design. *How engineering students can learn design engineering through projects?* *How students can take up problems to learn design engineering?*	1
4.2	Modular Design and Life Cycle Design Approaches. *What is modular approach in design engineering? How it helps?* *How the life cycle design approach influences design decisions?*	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. *How do aesthetics and ergonomics change engineering designs?* *How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?*	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. *How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?*	1
4.5	Case Studies: Bio-mimicry based Designs. *Conduct exercises to develop new designs for simple*	1

	products using bio-mimicry and train students to bring out new nature inspired designs.	
5	**Module 5: Expediency, Economics and Environment in Design Engineering**	
5.1	Design for Production, Use, and Sustainability. *How designs are finalized based on the aspects of production methods, life span, reliability and environment?*	1
5.2	Engineering Economics in Design. *How to estimate the cost of a particular design and how will economics influence the engineering designs?*	1
5.3	Design Rights. *What are design rights and how can an engineer put it into practice?*	1
5.4	Ethics in Design. *How do ethics play a decisive role in engineering design?*	1
5.5	Case Studies: Design for Production, Use, and Sustainability. *Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors.*	1
Second Series Examination		

Code.	Course Name	L	T	P	Hrs	Credit
HUT 200	**Professional Ethics**	2	0	0	2	2

Preamble: To enable students to create awareness on ethics and human values.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the core values that shape the ethical behaviour of a professional.
CO 2	Adopt a good character and follow an ethical life.
CO 3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.
CO 5	Apply the knowledge of human values and social values to contemporary ethical values and global issues.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1								2			2	
CO 2								2			2	
CO 3								3			2	
CO 4								3			2	
CO 5								3			2	

Assessment Pattern

Bloom's category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understood	20	20	40
Apply	15	15	30

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	:	10 marks
Continuous Assessment Tests (2 Nos)	:	25 marks
Assignments/Quiz	:	15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define integrity and point out ethical values.
2. Describe the qualities required to live a peaceful life.
3. Explain the role of engineers in modern society.

Course Outcome 2 (CO2)

1. Derive the codes of ethics.
2. Differentiate consensus and controversy.
3. Discuss in detail about character and confidence.

Course Outcome 3(CO3):

1. Explain the role of professional's ethics in technological development.
2. Distinguish between self interest and conflicts of interest.
3. Review on industrial standards and legal ethics.

Course Outcome 4 (CO4):

1. Illustrate the role of engineers as experimenters.
2. Interpret the terms safety and risk.
3. Show how the occupational crimes are resolved by keeping the rights of employees.

Course Outcome 5 (CO5):

1. Exemplify the engineers as managers.
2. Investigate the causes and effects of acid rain with a case study.
3. Explorate the need of environmental ethics in technological development.

Model Question paper

QP CODE: **Reg No:_____**

PAGES:3 **Name :_____**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 200
Course Name: PROFESSIONAL ETHICS

Max. Marks: 100 **Duration: 3 Hours**

(2019-Scheme)

PART A

(Answer all questions, each question carries 3 marks)

1. Define empathy and honesty.
2. Briefly explain about morals, values and ethics.
3. Interpret the two forms of self-respect.
4. List out the models of professional roles.
5. Indicate the advantages of using standards.
6. Point out the conditions required to define a valid consent?
7. Identify the conflicts of interests with an example?
8. Recall confidentiality.
9. Conclude the features of biometric ethics.
10. Name any three professional societies and their role relevant to engineers.

(10x3 = 30 marks)

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Classify the relationship between ethical values and law?

b) Compare between caring and sharing. (10+4 = 14 marks)

Or

12. a) Exemplify a comprehensive review about integrity and respect for others.

b) Discuss about co-operation and commitment. (8+6 = 14 marks)

MODULE II

13.a) Explain the three main levels of moral developments, deviced by Kohlberg.

b) Differentiate moral codes and optimal codes. (10+4 = 14 marks)

Or

14. a) Extrapolate the duty ethics and right ethics.

b) Discuss in detail the three types of inquiries in engineering ethics (8+6 = 14 marks)

MODULE III

Summarize the following features of morally responsible engineers.

(i) Moral autonomy **(ii)** Accountability

b)Explain the rights of employees (8+6 = 14 marks)

Or

16. a) Explain the reasons for Chernobyl mishap ?

b) Describe the methods to improve collegiality and loyalty. (8+6 = 14 marks)

MODULE IV

17.a) Execute collegiality with respect to commitment, respect and connectedness.

b) Identify conflicts of interests with an example. (8+6 = 14 marks)

Or

18. a) Explain in detail about professional rights and employee rights.

b) Exemplify engineers as managers.

MODULE V

19.**a)** Evaluate the technology transfer and appropriate technology.

b) Explain about computer and internet ethics. (8+6 = 14 marks)

Or

20. a) Investigate the causes and effects of acid rain with a case study.

b) Conclude the features of ecocentric and biocentric ethics. (8+6 = 14 marks)

Syllabus

Module 1 – Human Values.

Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment- Empathy-Self Confidence -Social Expectations.

Module 2 - Engineering Ethics & Professionalism.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional roles-Theories about right action –Self interest-Customs and Religion- Uses of Ethical Theories.

Module 3- Engineering as social Experimentation.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Module 4- Responsibilities and Rights.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.

Module 5- Global Ethical Issues.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors-Moral leadership.

Text Book

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

Reference Books

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

Course Contents and Lecture Schedule

SL.No	Topic	No. of Lectures 25
1	**Module 1 – Human Values.**	
1.1	Morals, values and Ethics, Integrity, Academic Integrity,Work Ethics	1
1.2	Service Learning, Civic Virtue, Respect for others, Living peacefully	1
1.3	Caring and Sharing, Honesty, Courage, Co-operation commitment	2
1.4	Empathy, Self Confidence, Social Expectations	1
2	**Module 2- Engineering Ethics & Professionalism.**	
2.1	Senses of Engineering Ethics, Variety of moral issues, Types of inquiry	1
2.2	Moral dilemmas, Moral Autonomy, Kohlberg's theory	1
2.3	Gilligan's theory, Consensus and Controversy,Profession& Professionalism, Models of professional roles, Theories about right action	2
2.4	Self interest-Customs and Religion, Uses of Ethical Theories	1
3	**Module 3- Engineering as social Experimentation.**	
3.1	Engineering as Experimentation, Engineers as responsible Experimenters	1
3.2	Codes of Ethics,Plagiarism, A balanced outlook on law	2
3.3	Challenger case study, Bhopal gas tragedy	2
4	**Module 4- Responsibilities and Rights.**	
4.1	Collegiality and loyalty, Managing conflict, Respect for authority	1
4.2	Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest	2
4.3	Occupational crime, Professional rights, Employee right, IPR Discrimination	2
5	**Module 5- Global Ethical Issues.**	
5.1	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics	2
5.2	Role in Technological Development, Moral leadership	1
5.3	Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	2

SEMESTER -4

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCN202	CONSTITUTION OF INDIA		2	0	0	NIL

Preamble:

The study of their own country constitution and studying the importance environment as well as understanding their own human rights help the students to concentrate on their day to day discipline. It also gives the knowledge and strength to face the society and people.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the background of the present constitution of India and features.
CO 2	Utilize the fundamental rights and duties.
CO 3	Understand the working of the union executive, parliament and judiciary.
CO 4	Understand the working of the state executive, legislature and judiciary.
CO 5	Utilize the special provisions and statutory institutions.
CO 6	Show national and patriotic spirit as responsible citizens of the country

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	2	2		2		
CO 2						3	3	3		3		
CO 3						3	2	3		3		
CO 4						3	2	3		3		
CO 5						3	2	3		3		
CO 6						3	3	3		2		

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	40
Understand	20	20	40
Apply	10	10	20
Analyse			

Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1 Discuss the historical background of the Indian constitution.

2 Explain the salient features of the Indian constitution.

3 Discuss the importance of preamble in the implementation of constitution.

Course Outcome 2 (CO2)

1 What are fundamental rights ? Examine each of them.

2 Examine the scope of freedom of speech and expression underlying the constitution.

3 The thumb impression of an accused is taken by the police against his will. He contends that this is a violation of his rights under Art 20(3) of the constitution. Decide.

Course Outcome 3(CO3):

1 Explain the powers of the President to suspend the fundamental rights during emergency.

2 Explain the salient features of appeal by special leave.

3. List the constitutional powers of President.

Course Outcome 4 (CO4):

1 Discuss the constitutional powers of Governor.

2 Examine the writ jurisdiction of High court.

3 Discuss the qualification and disqualification of membership of state legislature.

Course Outcome 5 (CO5):

1 Discuss the duties and powers of comptroller of auditor general.

2 Discuss the proclamation of emergency.

3 A state levies tax on motor vehicles used in the state, for the purpose of maintaining roads in the state. X challenges the levy of the tax on the ground that it violates the freedom of interstate commerce guaranteed under Art 301. Decide.

Course Outcome 6 (CO6):

1 Explain the advantages of citizenship.

2 List the important principles contained in the directive principles of state policy.

3 Discuss the various aspects contained in the preamble of the constitution

Model Question paper

PART A

(Answer all questions. Each question carries 3 marks)

1 Define and explain the term constitution.

2 Explain the need and importance of Preamble.

3 What is directive principle of state policy?

4 Define the State.

5 List the functions of Attorney general of India.

6 Explain the review power of Supreme court.

7 List the qualifications of Governor.

8 Explain the term and removal of Judges in High court.

9 Explain the powers of public service commission.

10 List three types of emergency under Indian constitution.

(10X3=30marks)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

PART B

(Answer on question from each module. Each question carries 14 marks)

Module 1

11 Discuss the various methods of acquiring Indian citizenship.

12 Examine the salient features of the Indian constitution.

Module 2

13 A high court passes a judgement against X. X desires to file a writ petition in the supreme court under Art32, on the ground that the judgement violates his fundamental rights. Advise him whether he can do so.

14 What is meant by directive principles of State policy? List the directives.

Module3

15 Describe the procedure of election and removal of the President of India.

16 Supreme court may in its discretion grant special leave to appeal. Examine the situation.

Module 4

17 Discuss the powers of Governor.

18 X filed a writ petition under Art 226 which was dismissed. Subsequently, he filed a writ petition under Art 32 of the constitution, seeking the same remedy. The Government argued that the writ petition should be dismissed, on the ground of res judicata. Decide.

Module 5

19 Examine the scope of the financial relations between the union and the states.

20 Discuss the effects of proclamation of emergency.

(14X5=70marks)

Syllabus

Module 1 Definition, historical back ground, features, preamble, territory, citizenship.

Module 2 State, fundamental rights, directive principles, duties.

Module 3 The machinery of the union government.

Module 4 Government machinery in the states

Module 5 The federal system, Statutory Institutions, miscellaneous provisions.

Text Books

1 D D Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi, 24e, 2019

2 PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

Reference Books

1 Ministry of law and justice, The constitution of India, Govt of India, New Delhi, 2019.

2 JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019

3 MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1**	
1.1	Definition of constitution, historical back ground, salient features of the constitution.	1
1.2	Preamble of the constitution, union and its territory.	1
1.3	Meaning of citizenship, types, termination of citizenship.	2
2	**Module 2**	
2.1	Definition of state, fundamental rights, general nature, classification, right to equality ,right to freedom , right against exploitation	2

2.2	Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences.	2
2.3	Directive principles of state policy, classification of directives, fundamental duties.	2
3	**Module 3**	
3.1	The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions.	2
3.2	The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament.	2
3.3	Union judiciary, the supreme court, jurisdiction, appeal by special leave.	1
4	**Module 4**	
4.1	The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories.	2
4.2	The State Legislature, composition, qualification and disqualification of membership, functions.	2
4.3	The state judiciary, the high court, jurisdiction, writs jurisdiction.	1
5	**Module 5**	
5.1	Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission.	1
5.2	Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals.	2
5.3	Official language, elections, special provisions relating to certain classes, amendment of the Constitution.	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
EST 200	DESIGN AND ENGINEERING		2	0	0	2

Preamble:

The purpose of this course is to

i) introduce the undergraduate engineering studentsthe fundamental principles of design engineering,

ii) make them understand the steps involved in the design process and

iii) familiarize them with the basic tools used and approaches in design.

Students are expected to apply design thinking in learning as well as while practicing engineering, which is very important and relevant for today. Case studies from various practical situations will help the students realize that design is not only concerned about the function but also many other factors like customer requirements, economics, reliability, etc. along with a variety of life cycle issues.

The course will help students to consider aesthetics, ergonomics and sustainability factors in designs and also to practice professional ethics while designing.

Prerequisite:

Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.

Course Outcomes:

After the completion of the course the student will be able to

CO 1	Explain the different concepts and principles involved in design engineering.
CO 2	Apply design thinking while learning and practicing engineering.
CO 3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1					1			1		
CO 2		2				1		1				2
CO 3			2			1	1		2	2		1

Assessment Pattern

Continuous Internal Evaluation (CIE) Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination (ESE) Pattern: There will be two parts; Part A and Part B.
Part A : 30 marks
part B : 70 marks
Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions.
Part B contains 2 case study questions from each module of which student should answer any one. Each question carry 14 marks and can have maximum 2 sub questions.

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	10	10	20
Apply	35	35	70
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1): Appreciate the different concepts and principles involved in design engineering.

1. State how engineering design is different from other kinds of design

2. List the different stages in a design process.

3. Describedesign thinking.

4. State the function of prototyping and proofing in engineering design.

5. Write notes on the following concepts in connection with design engineering 1) Modular Design, 2) Life Cycle Design , 3) Value Engineering, 4) Concurrent Engineering, and 5) Reverse Engineering

6. State design rights.

Course Outcome 2 (CO2) Apply design thinking while learning and practicing engineering.

1. Construct the iterative process for design thinking in developing simple products like a pen, umbrella, bag, etc.

2. Show with an example how divergent-convergent thinking helps in generating alternative designs and then how to narrow down to the best design.

3. Describe how a problem-based learning helps in creating better design engineering solutions.

4. Discuss as an engineer, how ethics play a decisive role in your designs

Course Outcome 3(CO3): Develop innovative, reliable, sustainable and economically viable designs incorporating different segments of knowledge in engineering.

1. Illustratethe development of any simple product by passing through the different stages of design process

2. Show thegraphical design communication with the help of detailed 2D or 3D drawings for any simple product.

3. Describe how to develop new designs for simple products through bio-mimicry.

Model Question paper

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION

Course Code: EST 200

Course Name: DESIGN AND ENGINEERING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each question carries 3 marks

Use only hand sketches

(1) Write aboutthe basic design process.

(2) Describe how to finalize the design objectives.

(3) State the role of divergent-convergent questioning in design thinking.

(4) Discuss how to perform design thinking in a team managing the conflicts.

(5) Show how engineering sketches and drawings convey designs.

(6) Explain the role of mathematics and physics in design engineering process.

(7) Distinguish between project-based learning and problem-based learning in design engineering.

(8) Describe how concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?

(9) Show how designs are varied based on the aspects of production methods, life span, reliability and environment?

(10) Explain how economics influence the engineering designs?

(10x3 marks =30 marks)

Part B

Answer any ONE question from each module. Each question carry 14 marks

Module 1

(11) Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.

or

(12) Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Module 2

(13) Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

or

(14) Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Module 3

(15) Graphically communicate the design of a thermo flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.

or

(16) Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.

Module 4

(17) Show the development of a nature inspired design for a solar poweredbus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.

or

(18) Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

Module 5

(19) Examine the changes in the design of a foot wear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.

or

(20) Describe the how to estimate the cost of a particular design using ANY of the following: i) a website, ii) the layout of a plant, iii) the elevation of a building, iv) anelectrical or electronic system or device and v) a car.

Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

(5x14 marks =70 marks)

Syllabus

Module 1

Design Process:- Introduction to Design and Engineering Design, Defining a Design Process-:Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.

Module 2

Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.

Module 3

Design Communication (Languages of Engineering Design):-Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.

Module 4

Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design.Modular Design and Life Cycle Design Approaches. Application of Bio-mimicry,Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.

Module 5

Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design

Text Books

1) YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285,

2) Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

Reference Books

1. Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.
2. Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5
3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
4. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1: Design Process**	
1.1	Introduction to Design and Engineering Design. *What does it mean to design something? How Is engineering design different from other kinds of design? Where and when do engineers design? What are the basic vocabularyin engineering design? How to learn and do engineering design.*	1
1.2	*Defining a Design Process*-: Detailing Customer Requirements. *How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?*	1
1.3	*Defining a Design Process*-: Setting Design Objectives, Identifying Constraints, Establishing Functions. *How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?*	1
1.4	*Defining a Design Process*-: Generating Design Alternatives and Choosing a Design. *How to generate or create feasible design alternatives? How to identify the "best possible design"?*	1
1.5	Case Studies:- Stages of Design Process. *Conduct exercises for designing simple products going through the different stages of design process.*	1
2	**Module 2: Design Thinking Approach**	
2.1	Introduction to Design Thinking *How does the design thinking approach help engineers in creating innovative and efficient designs?*	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. *How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?*	1
2.3	Design Thinking as Divergent-Convergent Questioning. *Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'.*	1
2.4	Design Thinking in a Team Environment. *How to perform design thinking as a team managing the conflicts ?*	1
2.5	Case Studies: Design Thinking Approach. *Conduct exercises using the design thinking approach for*	1

	designing any simple products within a limited time and budget	
3	**Module 3: Design Communication (Languages of Engineering Design)**	
3.1	Communicating Designs Graphically. *How do engineering sketches and drawings convey designs?*	1
3.2	Communicating Designs Orally and in Writing. *How can a design be communicated through oral presentation or technical reports efficiently?*	1
	First Series Examination	
3.3	Mathematical Modelling in Design. *How do mathematics and physics become a part of the design process?*	1
3.4	Prototyping and Proofing the Design. *How to predict whether the design will function well or not?*	1
3.5	Case Studies: Communicating Designs Graphically. *Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.*	1
4	**Module 4: Design Engineering Concepts**	
4.1	Project-based Learning and Problem-based Learning in Design. *How engineering students can learn design engineering through projects?* *How students can take up problems to learn design engineering?*	1
4.2	Modular Design and Life Cycle Design Approaches. *What is modular approach in design engineering? How it helps?* *How the life cycle design approach influences design decisions?*	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. *How do aesthetics and ergonomics change engineering designs?* *How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?*	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. *How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?*	1
4.5	Case Studies: Bio-mimicry based Designs. *Conduct exercises to develop new designs for simple*	1

	products using bio-mimicry and train students to bring out new nature inspired designs.	
5	**Module 5: Expediency, Economics and Environment in Design Engineering**	
5.1	Design for Production, Use, and Sustainability. *How designs are finalized based on the aspects of production methods, life span, reliability and environment?*	1
5.2	Engineering Economics in Design. *How to estimate the cost of a particular design and how will economics influence the engineering designs?*	1
5.3	Design Rights. *What are design rights and how can an engineer put it into practice?*	1
5.4	Ethics in Design. *How do ethics play a decisive role in engineering design?*	1
5.5	Case Studies: Design for Production, Use, and Sustainability. *Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors.*	1
Second Series Examination		

Code.	Course Name	L	T	P	Hrs	Credit
HUT 200	**Professional Ethics**	2	0	0	2	2

Preamble: To enable students to create awareness on ethics and human values.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the core values that shape the ethical behaviour of a professional.
CO 2	Adopt a good character and follow an ethical life.
CO 3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.
CO 5	Apply the knowledge of human values and social values to contemporary ethical values and global issues.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1								2			2	
CO 2								2			2	
CO 3								3			2	
CO 4								3			2	
CO 5								3			2	

Assessment Pattern

Bloom's category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understood	20	20	40
Apply	15	15	30

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	:	10 marks
Continuous Assessment Tests (2 Nos)	:	25 marks
Assignments/Quiz	:	15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define integrity and point out ethical values.
2. Describe the qualities required to live a peaceful life.
3. Explain the role of engineers in modern society.

Course Outcome 2 (CO2)

1. Derive the codes of ethics.
2. Differentiate consensus and controversy.
3. Discuss in detail about character and confidence.

Course Outcome 3(CO3):

1. Explain the role of professional's ethics in technological development.
2. Distinguish between self interest and conflicts of interest.
3. Review on industrial standards and legal ethics.

Course Outcome 4 (CO4):

1. Illustrate the role of engineers as experimenters.
2. Interpret the terms safety and risk.
3. Show how the occupational crimes are resolved by keeping the rights of employees.

Course Outcome 5 (CO5):

1. Exemplify the engineers as managers.
2. Investigate the causes and effects of acid rain with a case study.
3. Explorate the need of environmental ethics in technological development.

Model Question paper

QP CODE: **Reg No:_____**

PAGES:3 **Name :_____**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 200
Course Name: PROFESSIONAL ETHICS

Max. Marks: 100 **Duration: 3 Hours**

(2019-Scheme)

PART A

(Answer all questions, each question carries 3 marks)

1. Define empathy and honesty.
2. Briefly explain about morals, values and ethics.
3. Interpret the two forms of self-respect.
4. List out the models of professional roles.
5. Indicate the advantages of using standards.
6. Point out the conditions required to define a valid consent?
7. Identify the conflicts of interests with an example?
8. Recall confidentiality.
9. Conclude the features of biometric ethics.
10. Name any three professional societies and their role relevant to engineers.

(10x3 = 30 marks)

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Classify the relationship between ethical values and law?

b) Compare between caring and sharing. (10+4 = 14 marks)

Or

12. a) Exemplify a comprehensive review about integrity and respect for others.

b) Discuss about co-operation and commitment. (8+6 = 14 marks)

MODULE II

13.a) Explain the three main levels of moral developments, deviced by Kohlberg.

b) Differentiate moral codes and optimal codes. (10+4 = 14 marks)

Or

14. a) Extrapolate the duty ethics and right ethics.

b) Discuss in detail the three types of inquiries in engineering ethics (8+6 = 14 marks)

MODULE III

Summarize the following features of morally responsible engineers.

(i) Moral autonomy **(ii)** Accountability

b)Explain the rights of employees (8+6 = 14 marks)

Or

16. a) Explain the reasons for Chernobyl mishap ?

b) Describe the methods to improve collegiality and loyalty. (8+6 = 14 marks)

MODULE IV

17.a) Execute collegiality with respect to commitment, respect and connectedness.

b) Identify conflicts of interests with an example. (8+6 = 14 marks)

Or

18. a) Explain in detail about professional rights and employee rights.

b) Exemplify engineers as managers.

MODULE V

19.**a)** Evaluate the technology transfer and appropriate technology.

b) Explain about computer and internet ethics. (8+6 = 14 marks)

Or

20. a) Investigate the causes and effects of acid rain with a case study.

b) Conclude the features of ecocentric and biocentric ethics. (8+6 = 14 marks)

Syllabus

Module 1 – Human Values.

Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment- Empathy-Self Confidence -Social Expectations.

Module 2 - Engineering Ethics & Professionalism.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional roles-Theories about right action –Self interest-Customs and Religion- Uses of Ethical Theories.

Module 3- Engineering as social Experimentation.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Module 4- Responsibilities and Rights.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.

Module 5- Global Ethical Issues.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and advisors-Moral leadership.

Text Book

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

Reference Books

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

Course Contents and Lecture Schedule

SL.No	Topic	No. of Lectures 25
1	**Module 1 – Human Values.**	
1.1	Morals, values and Ethics, Integrity, Academic Integrity,Work Ethics	1
1.2	Service Learning, Civic Virtue, Respect for others, Living peacefully	1
1.3	Caring and Sharing, Honesty, Courage, Co-operation commitment	2
1.4	Empathy, Self Confidence, Social Expectations	1
2	**Module 2- Engineering Ethics & Professionalism.**	
2.1	Senses of Engineering Ethics, Variety of moral issues, Types of inquiry	1
2.2	Moral dilemmas, Moral Autonomy, Kohlberg's theory	1
2.3	Gilligan's theory, Consensus and Controversy,Profession& Professionalism, Models of professional roles, Theories about right action	2
2.4	Self interest-Customs and Religion, Uses of Ethical Theories	1
3	**Module 3- Engineering as social Experimentation.**	
3.1	Engineering as Experimentation, Engineers as responsible Experimenters	1
3.2	Codes of Ethics,Plagiarism, A balanced outlook on law	2
3.3	Challenger case study, Bhopal gas tragedy	2
4	**Module 4- Responsibilities and Rights.**	
4.1	Collegiality and loyalty, Managing conflict, Respect for authority	1
4.2	Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest	2
4.3	Occupational crime, Professional rights, Employee right, IPR Discrimination	2
5	**Module 5- Global Ethical Issues.**	
5.1	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics	2
5.2	Role in Technological Development, Moral leadership	1
5.3	Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	2