APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CET Campus, Thiruvananthapuram, Kerala-695016

SYLLABUS
For

MASTER OF COMPUTER APPLICATIONS
(REGULAR)

Semester 1

	Master of Computer Applications (Regular)	Hours / week			IA Marks	ESE Marks	Total	Credits	Exam Slot
Course No	Course	L	T	P					
RLMCA101	Problem Solving and Computer Programming	3	1		40	60	100	4	A
RLMCA103	Discrete Mathematics	3	1	-	40	60	100	4	B
RLMCA105	Applied Probability and Statistics	3	1	-	40	60	100	4	C
RLMCA107	Principles of Management	3	1	-	40	60	100	4	D
RLMCA109	Digital Fundamentals	3	1	-	40	60	100	4	E
RLMCA131	Programming Lab	-		4	100		100	1	S
RLMCA133	Applied Statistics Lab	-		4	100		100	1	T
		15	**5**	**8**	**400**	**300**	**700**	**22**	

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA101	Problem Solving & Computer Programming	3-1-0-4	2016

Course Objectives

- To introduce a basic step towards Software Development
- To learn the C language
- To develop the programming skill, using C language

Syllabus

Program Development, Structured Programming, Introduction to C, Operators and Expressions, Data Input and Output, Control Statements, Functions, Program Structure, Arrays, Strings, Structure and Union, Pointers, File Handling, Low Level Programming, Additional Features of C.

Expected Outcome

- Ability to solve problems systematically and to implement the solution in C language.
- Develop programming skills
- Develop the knowledge of how to learn a programming language, which will help in learning other Computer Languages in the curriculum

References

1. Byron S Gottfried, "Programming with C", Schaum's outline, 3rd Edition, McGraw Hill
2. A. N. Kamthane, "Programming in C", Pearson Education, 3rd Edition (2015)
3. Brian W Kernighan & Dennis Ritchie, "The C programming language", 2nd Edition, Prentice Hall (2015)
4. Reema. Thareja, "Programming in C", Oxford University Press, 2nd Edition (2016)
5. Stephen Prata K, "C Primer Plus", Pearson Education, 5th Edition (2013)
6. K N King, "C Programming: A Modern Approach", W. W. Norton & Co, 2nd Edition (1996)

Suggested MOOC

1. https://www.edx.org/course/programming-basics-iitbombayx-cs101-1x
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Introductory concepts: Program Development - Algorithm, Flowchart, Pseudocode, Structured Programming – Program Design, Modular Programming, Structuring of Control Flow. Introduction to C Language: The C character set, identifiers and keywords, data types, constants, variables and arrays, declarations, expressions, statements, Symbolic Constants, Library Functions.	6	10
II	Operators and expressions: Arithmetic operators, Unary operators, Relational and Logical operators, Assignment operators, Conditional operator. Data input and output: Single character input, single character output, scanf, printf, puts, gets, functions, interactive programming.	6	10
FIRST INTERNAL EXAM			
III	Control statements: Branching - if else statement, Looping, nested control structure, switch statement, break statement, continue statement, comma operator, goto statement. Functions: Overview, function prototypes, passing arguments to a function, recursion. Program structure: Storage classes, automatic variables, external variables, static variables, multifile program, Library files, Header files.	10	20
IV	Arrays: Defining an array, passing array to functions, multidimensional arrays. Strings: Defining a string, Null Character, Initialization, Reading, writing and processing a string. Structures and unions: Defining a structure, processing a structure, user defined data types, structure and pointers*, passing structure to function*, self-referential structures*, union.	8	20
V	Pointers: Fundamentals, Declaration, Passing pointers to a function, pointers and one dimensional arrays, dynamic memory allocation, operations on pointers, pointers and multidimensional arrays, array of pointers, Array of strings, pointers and variable length arguments list, passing functions to other functions.	8	20
SECOND INTERNAL EXAM			
VI	File Handling: opening and closing a data file, reading and writing a data file, processing a data file, unformatted data file, Random accessing. Low level programming: Register variable, bitwise operations, bit fields. Additional features of C: Enumeration, Command line parameters, Macros, C Preprocessor.	7	20
END SEMESTER EXAM			

**May be covered after Module V*

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA103	Discrete Mathematics	3-1-0-4	2016

Course Objectives

- To give an understanding of important mathematical concepts together with a sense of why these concepts are important for computer science.
- To provide a foundation of set theory, Congruences, Counting techniques and Graph theory.

Syllabus

Logic, Sets, Relations, Functions, Division algorithm, Congruences, Counting techniques, Advanced Counting Techniques, Graphs and Graph Models.

Expected Outcome

At the end of the course, students would

- Students will be capable of using the mathematical methods and algorithms learned for analyzing and solving problems related to Computer Science.

References

1. Kenneth H. Rosen , "Discrete mathematics and its applications", McGraw-Hill, (7th Edition), (Smartbook available).
2. Swapan Kumar Chakroborthy ,Bikash Kanthi Sarkar, "Discrete Mathematics ", Oxford University Press (2010).
3. David M. Burton, "Elementary Number Theory", McGraw-Hill, 7th Edition (2012).
4. Ralph P Grimaldi, "Discrete and Computational Mathematics: An applied introduction", Pearson Education, 5th Edition, (2007).
5. Joe R. Mott, Abraham Kandel, Theodore P Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Pearson Education, 2nd Edition (2015)
6. Marty Lewinter, Jeanine Meyer, "Elementary Number Theory with Programming", Wiley-Blackwell (2015).
7. Jean-Paul Tremblay , "Discrete Mathematical Structures with applications to Computer science", ", McGraw-Hill, 1st Edition (2001).
8. C. Liu, "Elements of Discrete Mathematics: A Computer Oriented Approach", McGraw-Hill, 4th Edition (2012).
9. Y.N. Singh, "Discrete Mathematical Structures ", Wiley India Pvt. Ltd (2010)
10. R.K Bisht and H.S Dhami, "Discrete Mathematics ", Oxford University Press, 1st Edition (2015)

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	**Basic Structures -** Sets, Set Operations, Relations, Classification of relations, Equivalence Relations, Closures of Relations, Matrix Representation of Relations, Partial Ordering, n-ary Relations, Functions. **Relevant Portions from Text 2 primarily and Text 1 for additional reference**	8	15
II	Division Algorithm, GCD, Primes, Euclidean Algorithm, Congruences, Properties of Congruences, Solutions of Linear Congruences, Chinese Remainder Theorem. **Text 3: 2.2, 2.3, 2.4, 4.2, 4.4 and Text 1 for additional reference**	8	15
FIRST INTERNAL EXAM			
III	Permutations, Circular Permutations, Combinations,Combinations with repetition, Binomial Theorem, Pigeonhole Principle, Principle of Inclusion and exclusion **Text 4: 1.2, 1.3, 5.5, 8.1 and Text 1 for additional reference**	8	15
IV	Generalization of Principle of Inclusion and Exclusion, First Order Linear Recurrence Relation, Second Order Linear homogeneous Recurrence Relations with Constant coefficients, Non Homogeneous Recurrence Relation, Divide-and-Conquer Algorithms and Recurrence Relations **Text 4: 8.3, 10.1, 10.2, 10.3 and Text 1 for additional reference**	8	15
V	**Graphs** - and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring Graphs, Directed Graph, Multigraph, Connected graph, Graph Isomorphism, Euler circuit and trail, Fleury's Algorithm, Planar and NonPlanar Graphs, Bipartite Graph, Kuratowski's Theorem(without proof), Cut-set, Hamiton path and cycle. **Text 4: 11.1, 11.2, 11.3, 11.4, 11.5 and Text 1 for additional reference** **(proof of theorems 11.6, 11.8 and 11.9 are not required)**	9	20
SECOND INTERNAL EXAM			
VI	**Logic -** Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of inference. **Text 1**	9	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA105	Applied Probability and Statistics	3-1-0-4	2016

Course Objectives

- To introduce probability theory and statistics from a computational perspective.
- To prepare students for learning advanced courses like machine learning and big data
- The focus to be on understanding the ideas behind statistics and probability. The treatment would not be mathematically rigorous. Each topic should be taught from a practical point of view. Each topic should be taught with suitable simulations in the class. Software packages like R, Excel, SPSS, PSPP or any other suitable software can be used for this.

Syllabus

Introduction to statistics, Concepts of probability theory, Distributions, Mathematical expectations. Moments, Inferential statistics, Hypothesis testing, regression models.

Expected Outcome

- At the end of the course students will have an overall view of concepts in probability and statistics.

References

1. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", Wiley India, 5th Edition (2012).
2. David S. Moore and George P. McCabe, "Introduction to practice of statistics", W.H. Freeman & Company, 5th Edition (2005).
3. G. Jay Kerns, "Introduction to Probability and Statistics Using R", Chapman & Hall (2010) https://cran.r-project.org/web/packages/IPSUR/vignettes/IPSUR.pdf
4. Richard A .Johnson, Miller and Freunds, "Probability and Statistics for Engineers", Prentice Hall of India, 8th Edition (2015).
5. Gupta S.C and Kapoor V .K, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons (2014).
6. Mendenhall, Beaver, Beaver, Introduction to Probability & Statistics, Cengage Learning, 14th Edition (2014)

Web Resources

1. Probability and statistics EBook http://wiki.stat.ucla.edu/socr/index.php/EBook
2. https://www.openintro.org/stat/textbook.php
3. http://www.math.uah.edu/stat/index.html
4. Statistics Online Computational Resource http://www.socr.ucla.edu/

Suggested MOOCs

1. https://www.edx.org/course/explore-statistics-r-kix-kiexplorx-0
2. https://www.coursera.org/course/probability
3. http://www.math.uah.edu/stat/

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Introduction to Statistics and Data, Types of Data - Quantitative Data, Qualitative Data, Logical Data, Multivariate Data etc. Features of Data distributions - Center, Spread, Shape, Symmetry, Skewness and Kurtosis (Definitions only), Frequency Distributions and Histogram, Stem and Leaf Diagrams, Measures of Center - Mean, Median, Mode, Measures of Spread - Range, Variance, Standard Deviation, Measures of Relative Position: Quartiles, Percentiles, Interquartile range.	7	15
II	Introduction to Probability Theory - Classical empirical and subjective probabilities, Random Experiments, Sample Spaces & Events, Axioms of Probability, Addition Rules, Conditional Probability, Multiplication and Total Probability Rules, Independence, Bayes's Theorem (without proof).	7	15
FIRST INTERNAL EXAM			
III	Random Variables, Discrete Random Variables, Probability Distributions and Probability Mass Functions, Mean and Variance of a Discrete Random Variable, Discrete Uniform Distribution - Mean and Variance, Binomial Distribution - Mean and Variance, Geometric Distribution - Mean and Variance, Poisson Distribution - Mean and Variance.	10	20
IV	Continuous Random Variables, Probability Distributions and Probability Density Functions, Mean and Variance of a Continuous Random Variable, Continuous Uniform Distribution, Mean and Variance, Normal Distribution, Mean and Variance (Proof not required), Standard Normal Distribution, Joint and Marginal Probability Distributions, Conditional Probability Distributions, Independent Random Variables.	10	20
V	Statistical Inference, Types of sampling and sampling error, Random Sample & Statistic, Sampling Distribution, Central Limit Theorem (Statement Only), Distribution of sample mean and sample variance, t,$\chi^2 \wedge F$distributions (derivation not required), Confidence Interval on the Mean, Confidence Interval on the Variance, Confidence Interval for a Population Proportion, Confidence Interval on the Difference in Means, Confidence Interval on the Ratio of two Variances.	10	20
SECOND INTERNAL EXAM			
VI	Hypothesis Testing, General Procedure for Hypothesis Tests, Tests on the Mean, Tests on a population Proportion, Tests on the Difference in Means.	6	10
END SEMESTER EXAM			

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA107	Principles of Management	3-1-0-4	2016

Course Objectives

- To develop ability to critically analyze and evaluate a variety of management practices.
- To understand and apply a variety of management and organisational theories in practice.
- To be able to mirror existing practices or to generate their own innovative management competencies, required for today's complex and global workplace.

Syllabus

Definition, functions of a management, managerial skills and roles, basics of decision making process. Early contributors and their contributions to the field of management. Planning, Organizing, Staffing and HRD functions, Directing and Controlling form the core content of this course.

Expected Outcome

A student who has undergone this course

- would be able understand management as a process
- would be able to critically analyse and evaluate management theories and practices
- would be able to plan and make decisions for organisations
- would be able to do staffing and related HRD functions
- would be aware about quality standards
- would be able to understand the marketing basics

References

1. L M Prasad, “Principles of Management”, Sultan Chand & Sons, 8th Edition (2010)
2. Peter F Drucker, “The Practice of Management”, Butterworth-Heinemann publication, 2nd Edition (2007)
3. Harold Koontz and Heinz Weihrich, “Essentials of Management”, McGraw Hill Education, 10th Edition (2015).
4. Robbins and Coulter, Management, Pearson Education 13th Edition, 2016,
5. R N Gupta, “Principles of Management”, S. Chand & Company Ltd., (2010)
6. Tripathi, “Principles of Management”, McGraw Hill Education, 5th Edition (2012)

Suggested MOOCs

1. Management Functions
   http://nptel.ac.in/courses/122108038/
2. Leadership
   http://nptel.ac.in/courses/110105033/33

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	**Introduction to Management**: Basic Managerial Concepts, Levels of management, Managerial Skills, Managerial roles Decision Making- Concept, types of decision, decision making process. Management functions- Planning, Organising, Staffing, Directing and Controlling.	6	15
II	**Early Contributions in Management**: Management thought - Classical approach, scientific management, contributions of Taylor, Gilbreths, Fayol's 14 principles of management. Human relation approach - contribution of Elton Mayo Systems approach - organization as an open system and Contingency approach.	8	15
FIRST INTERNAL EXAM			
III	**Planning:** Nature and importance of planning, types of plans - Steps in planning, Levels of planning - The Planning Process - MBO definition and process, SWOT Analysis, importance.	7	15
IV	**Organising :** Nature of organizing, Departmentation - need and importance, span of control in management, factors affecting span of management. Organisation structure - Formal and informal, Types of organization structure line, line and staff, functional, divisional, project, matrix, free form, virtual. Delegation of authority, Steps in delegation and Principles of delegation	8	15
V	**Staffing and related HRD Functions:** meaning, nature, staffing process, Job analysis and manpower planning, job description and job specification, Recruitment & selection, selection process, tests and interviews. Training and development - concept and methods, Performance appraisal- concept and methods.	8	20
SECOND INTERNAL EXAM			
VI	**Directing and Controlling:** Supervision, Motivation - significance, motivational theories - Maslow's need hierarchy. Basic control process - control as a feedback system. Quality engineering, quality control, control chart (basic concepts), Introduction to ISO 9000 and 14000 standards, TQM, Six Sigma concepts, Bench marking, Introduction to marketing, marketing mix, Product Life cycle.	8	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA109	Digital Fundamentals	3-1-0-4	2016

Course Objectives

- To introduce students to the foundations of computer hardware.
- To introduce digital electronics

Syllabus

Number Systems, Logic Gates and Boolean algebra, Combinational and Sequential circuits, Registers and Counters, Introduction to Computers.

Expected Outcome

- Students will get a thorough knowledge of Digital electronics
- Students will be able to design simple logic circuits
- They will get an overall idea about single board computers like Arduino®, Raspberry Pi® etc.

References

1. Floyd, "Digital Fundamentals", Pearson Education, 10th Edition (2011).
2. Morris Mano, "Digital logic and Computer design", Pearson Education, 1st Edition (2004).
3. Morris Mano, "Logic and Computer Design Fundamentals",4th Edition (2013).
4. Nisan & Schocken, "The Elements of Computing Systems", MIT Press (2008)
5. Mano, "Digital Design : With an Introduction to Verilog HDL", Pearson Education, 5th Edition (2014)

Suggested MOOC

1. https://www.coursera.org/learn/build-a-computer

Course Plan			
Module	**Contents**	**Hours Allotted**	**% of marks in End-Semester Examination**
I	Introduction of number systems - Binary, Decimal and Hexadecimal-Conversions. Arithmetic operations on binary numbers, Representation of signed numbers - 1's compliment and 2s compliment - Representation of floating point numbers - BCD representation.	9	15
II	Logic gates and Boolean algebra - Basic gates - AND, OR, NOT, NAND, NOR, XOR - their symbols and truth tables. Boolean algebra - Basic laws and theorems - Boolean functions - truth table - minimization of Boolean function using K map method, Realization using logic gates and universal gates.	9	20
FIRST INTERNAL EXAM			
III	Combinational Circuits - Basic ideas about combinational circuits - Half adder - Full Adder, Parallel binary adder, Subtracter, Decoders, Encoders, Multiplexers, Demultiplexers, Parity bit generator.	10	20
IV	Sequential circuit - Basic ideas about sequential logic, Clocking, Flip flops RS, JK D and T flip flops, edge triggering , level triggering.	7	15
V	Registers and counters - Serial in serial out, Serial in Parallel out, Parallel in serial out, Parallel in Parallel out registers, Bidirectional shift registers, Synchronous and asynchronous counters, UP/DOWN counters, Modulo-N Counters.	7	20
SECOND INTERNAL EXAM			
VI	Introduction of Computers - Overview of PC architecture - Basic components of a computer - PC hardware – Motherboards - Expansion boards -Specifications of Personal computers. Introduction to single board computers - Arduino - architecture - Introduction to Arduino environment. Writing simple programs for blinking an LED, Input from an external switch, fading an LED, serial monitor and debugging. Raspberry pi : Introduction to Raspberry - Architecture, versions, Software installation and configuration. ***Note : The last module should be taught in a tutorial session. Students should be shown actual devices. A practical assignment about configuring a PC / arduino or raspberry pi should be given.***	8	10
END SEMESTER EXAM			

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA131	**Programming Lab**	**0-0-4-1**	**2016**

Course Objectives

- Companion course of RMCA101

Syllabus

Companion course of RMCA101. Practical aspects of RMCA101 to be covered in the laboratory Environment.

Expected Outcome

- The students will develop adequate programming skills

References

1. A. N. Kamthane, "Programming in C", Pearson Education, 3rd Edition (2015)
2. Brian W Kernighan & Dennis Ritchie, "The C programming language", 2nd Edition, Prentice Hall (2015)

Course plan		
Experiment No.	**Description**	**Hours Allotted**
1	Compilation and Executing programs Arithmetic operations Use of Symbolic constants Demonstrating the following gcc options -o, -c, -D, -l, -I, -g, -E Note : 1. ***Algorithm of every program should be written. Properly document the programs using comments. Author name and date, purpose of each variable and constructs like loop and functions should be indicated/ documented.*** 2. ***gcc or an equivalent compiler is assumed***.	50
2	Program to demonstrate the following Branching Nested Branching Looping Selection	
3	Using debugger Important Commands - break, run, next, print, display, help Functions Creating Header file for Function Prototype Compiling and storing Function Definition in Library (archive) file Calling the function Recursion Storage Classes Using register, extern and static	
4	Arrays 1D - Linear Search, Sort 2D - Matrix operations Strings Structure Union	
5	Pointers Dynamic Memory Allocation Structure Pointer Array of Pointers, Ragged Arrays Function pointer	
6	File Handling Low level programming Macros and Preprocessor	

Course No.	Course Name	L-T-P Credits	Year of Introduction
RLMCA133	Applied Statistics Lab	0-0-4-1	2016

Course Objectives

- To introduce students to modern statistical tools
- Prepare students for big data analysis course

Syllabus

Companion course of RMCA103, Practical aspects of RMCA103 to be covered in the laboratory Environment.

Expected Outcome

- Students will be able to apply statistical methods to real life problems

References

1. Jared P Lander, "R for everyone", Pearson education, 1st Edition (2014).
2. Dr. Mark Gardener, "Beginning R: The Statistical Programming Language", Wiley (2013)
3. Gnuu PSPP Team, "GNU PSPP Reference Manual", Samurai Media Limited (2015)

Web Resources

1. PSPP
   www.gnu.org/s/**pspp**/manual/**pspp**.pdf
2. Simple R
   http://www.math.csi.cuny.edu/Statistics/R/simpleR/

Suggested MOOCs

1. https://www.edx.org/course/analyzing-visualizing-data-excel-microsoft-dat206x-1
2. https://www.coursera.org/learn/analytics-excel
3. Instructors can also use the simulations material at
   http://wiki.stat.ucla.edu/socr/index.php/SOCR_EduMaterials

Course plan		
Experiment No.	**Description**	**Hours Allotted**
1	Visualizing Data Tables, charts and plots. Visualising Measures of Central Tendency, Variation, and Shape. Box plots, Pareto diagrams. How to find the mean median standard deviation and quantiles of a set of observations. Students may experiment with real as well as artificial data sets.	50
2	Probability Distributions. Set operations, simulation of various properties. Bays' rule. Generate and Visualize Discrete and continuous distributions using the statistical environment. Demonstration of CDF and PDF uniform and normal, binomial Poisson distributions. Students are expected to generate artificial data using the chosen statistical environment and explore various distribution and its properties. Various parameter changes may be studied.	
3	Random samples. How to generate random numbers. Study how to select a random sample with replacement from normal and uniform distribution. Students can use the built in functions to explore random sample selection.	
4	Study of binomial distribution. Plots of density and distribution functions. Normal approximation to the Binomial distribution. Central limit theorem.	
5	Study of confidence intervals. How to compute confidence intervals for the mean when the standard deviation is known.	
6	How to perform tests of hypotheses about the mean when the variance is known. How to compute the p-value. Explore the connection between the critical region, the test statistic, and the p-value.	
7	How to find quantiles of the t-distribution. How to perform a significance test for testing the mean of a population with unknown standard deviation.	
8	Compare populations means from two Normal distributions with unknown variance Tests of Hypotheses for One Proportion Tests of Hypotheses for Comparing Two Proportions	
9	How to calculate the correlation between two variables. How to make scatter plots. Use the scatterplot to investigate the relationship between two variables	
10	Find the least-squares regression line. How to calculate and plot the residuals.	

	Note : This laboratory is to be conducted with a suitable statistical software. The colleges can choose the statistical software. Some of the suggested environments are R, SciPy, SPSS Excel, or any other statistical analysis software depending on availability. ***The students are expected to write code for statistical applications using the chosen environment. The instructor may choose a standard data set and ask the students to work with it.***	