

B. TECH
ELECTRONICS & COMMUNICATION ENGINEERING
CURRICULUM & SYLLABUS
SEMESTER 3
2025 REGULATION



B. Tech

in

Electronics

and

Communication Engineering

2025 REGULATION

CURRICULUM & SYLLABUS

(Semester-3)

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SEMESTER-3

CURRICULUM

SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C
A	BST	B250802/MA300A	Mathematics for Electrical Science – 3	3	1	0	0	2	3
B	PCE	B250004/EC310B	Analog Circuits	3	1	0	3	5	6
C	PCE	B250004/EC310C	Logic Circuit Design	3	1	0	3	5	6
D	PCB	B250004/EC320D	Semiconductor Device Theory	2	1	1	0	4	4
E	EST	B250902/CN300E	Introduction to Artificial Intelligence and Data Science	3	0	0	0	5	4
F	HMT	B250908/HU900F	Engineering Economics	3	0	0	0	1	2
		B250908/CN900F	Management for Engineers						
M	M		Minor	3	1	0	0	4	4
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)</i>									

COURSE DESCRIPTION							
REGULATION	2025	L-T-J-P-S	3-1-0-0-2	VERSION	25/0	CREDITS	3
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B250802/ MA300A	MATHEMATICS FOR ELECTRICAL SCIENCE -3	BST
PRE-REQUISITE		
<ul style="list-style-type: none"> • Sound knowledge in calculus of single variable and multi-variable functions • Basic knowledge in complex numbers 		

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme						
L	T	J	P	S	90	C	Theory			Practical			Total
							CIA	ESE	Total	CIA	ESE	Total	
3	1	0	0	2		3	40	60	100	-	-	-	100
L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination													

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Partial Differential Equations	Introduction to partial differential equations, formation of partial differential equations, Method of separation of variables, Vibrations of a stretched string - wave Equation, Solutions of one-dimensional wave equation using method of separation of variables and problems, One-dimensional Heat equation, Solutions of One-Dimensional Heat equation - A long insulated rod with ends at zero temperatures. (Relevant topics from sections 17.1,17.2, 18.2,18.4,18.5 of Text 1).	12
2	Fourier Transforms	Fourier Integral theorem, Fourier Cosine and Sine integrals, Fourier Transform and its inverse, Properties of Fourier Transforms, Convolution theorem for Fourier Transforms, Parseval's identity for Fourier Transforms. (Relevant topics from sections 22.3,22.4, 22.5,22.6,22,7 of Text 1)	10
3	Complex Differentiation	Complex Function, Limit, Continuity, Derivative, Analytic functions, Cauchy-Riemann Equations (without proof), Laplace's Equations, Harmonic functions, Finding harmonic conjugate, Introduction to convergence and divergence of sequences and series, Taylor series and Maclaurin series, Laurent's theorem (statement only), Singularities and Zeros – Isolated Singularity, Poles, Essential Singularities, Removable singularities, Zeros of Analytic functions – Poles and Zeros. (Relevant topics from sections 13.3,13.4, 15.4,16.1,16.2 of Text 2)	11
4	Complex Integration	Line integrals in the complex plane (Definition & Basic properties), First evaluation method, second evaluation method, Cauchy's integral theorem on simply connected domain and multiply connected domain (without proof), Independence of path, Cauchy's Integral formula (without proof), Formulas for Residues, Residue theorem (without proof). (Relevant topics from sections 14.1,14.2, 14.3, 16.3 of Text 2)	12

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	B S Grewal	Khanna Publishers,44th edition,2017

2	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons, 10th edition, 2016
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Reference			
Sl. No.	Title of Book	Author	Publication
1	Advanced Engineering Mathematics	H.C Taneja	I.K. International publishing House Pvt. Ltd, 2014.
2	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education, 39th Edition, 2023
3	Engineering Mathematics	Babu Ram	Dorling Kindersley (India) Pvt. Ltd, 2010
4	Complex Analysis	Dennis G. Zill & Patrick D. Shanahan, Jones & Bartlett,	3rd Edition, 2015
5	Fast Fourier Transform - Algorithms and Applications	K.R. Rao, Do Nyeon Kim, & Jae Jeong Hwang	Springer, 1st Edition, 2011

COURSE DESCRIPTION							
REGULATION	2025	L-T-J-P-S	3-1-0-3-5	VERSION	25/0	CREDITS	6
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B250004/EC310B	ANALOG CIRCUITS	PCE
PRE-REQUISITE		
B250906/CN100D - Introduction to Electrical and Electronics Engineering B250004/EC200C - Principles of Electronics and Communication Engineering B250004/EC200E - Network Theory		

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme						
							Theory			Practical			Total
L	T	J	P	S	120	C	CIA	ESE	Total	CIA	ESE	Total	
3	1	0	3	5		120	6	25	40	65	15	20	35
<i>L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination</i>													

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Feedback amplifiers & Oscillators	Feedback amplifiers: The general feedback structure, Properties of negative feedback, Feedback voltage amplifier topologies, Analysis of discrete BJT circuits in voltage-series and voltage-shunt feedback topologies. Oscillators: Principles of sinusoidal oscillator, Analysis of oscillator circuits, Classification.	15
2	Power amplifiers & Linear Voltage Regulators	Power amplifiers: Introduction to power amplifiers, Classes of power amplifiers, Class A, Class B & Class AB power amplifiers, Class C & Class D Amplifiers. Linear Voltage Regulators: Types of voltage regulators, Load & line regulation, Short circuit protection and fold back protection.	15
3	JFET and MOSFET Operation and Characteristics	Field Effect Transistor: Introduction to JFET (Junction Field Effect Transistor), JFET Characteristics, JFET Parameters. MOSFET: Review of MOSFET - MOSFET DC circuit analysis , Small signal model, Biasing of MOSFET amplifiers.	15
4	MOSFET Amplifiers and Differential Amplifier Analysis	Analysis of single stage MOSFET amplifiers, Source follower amplifier, Common Gate amplifier. High frequency equivalent circuits of MOSFETs.	15

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Microelectronic Circuits,	Sedra and Smith	6/e, Oxford University Press 2003
2	Integrated Electronics,	Millman and Halkias	2/e, TMH, 2004.
3	Electronic Devices and Circuit Theory	R E Boylstead and L Nashelsky	11/e, Pearson Education, 2015

Reference			
Sl. No.	Title of Book	Author	Publication
1	Fundamentals of Microelectronics	B. Razavi	2/e, Wiley, 2013
2	Electronic Circuit Analysis and Design	Donald A Neamen.	3/e, TMH, 2006
3	Electronic Circuits and Devices	Theodore F. Bogart; Beasley, Jeffrey S.; Guillermo Rico	6/e, Pearson Education India

COURSE DESCRIPTION							
REGULATION	2025	L-T-J-P-S	3-1-0-3-5	VERSION	25/0	CREDITS	6
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B250004/EC310C	LOGIC CIRCUIT DESIGN	PCE
PRE-REQUISITE		
Basic knowledge of Electronics Engineering concepts.		

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme						
							Theory			Practical			Total
L	T	J	P	S	C	CIA	ESE	Total	CIA	ESE	Total		
3	1	0	3	5	120	6	25	40	65	15	20	35	100
L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination													

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Introduction to digital circuits	Introduction to digital circuits: Review of number systems (Binary, Decimal, Octal, Hexadecimal), conversions, Arithmetic of Binary number systems, Signed and unsigned numbers, BCD. Boolean algebra: Theorems, sum of product and product of sum - simplification, canonical forms- min term and max term, Simplification of Boolean expressions - Karnaugh map (upto 4 variables), Essential Prime Implicants and its significance, Implementation of Boolean expressions using universal gates. Introduction to Verilog HDL – Basic language elements, Basic implementation of logic gates	15
2	Combinational logic circuits	Half adder and Full adders, Subtractors, BCD adder, Ripple carry and carry look ahead adders, Decoders, Encoders, Code converters, Comparators, Parity generator, Multiplexers, De-multiplexers, Implementation of Boolean algebra using MUX. Implementation of combinational circuits using Verilog HDL	15
3	Sequential Circuits	SR Latch, Flip flops - SR, JK, Master-Slave JK, D and T Flip flops. Conversion of Flip flops, Excitation table and characteristic equation. Shift registers-SIPO, SISO, PISO, PIPO and Universal shift registers. Ring and Johnson counters. Design of Asynchronous, Synchronous and Mod N counters. Implementation of sequential circuits using Verilog HDL	15
4	Finite state machines	Design of synchronous sequential circuits using Finite State Machine (FSM): Mealy and Moore models, state diagrams (state graphs), state tables, state reduction techniques, and state assignment methods. Design and implementation of a sequence detector (overlapping and non-overlapping, single and multiple sequences). Logic Families: Electrical characteristics of logic gates, noise margin, fan-in, fan-out, propagation delay, transition time, and power-delay product.	15

		Overview and comparison of TTL, ECL, and CMOS logic families. Circuit description and working of TTL inverter, TTL NAND gate and TTL NOR gate.	
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SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Digital Fundamentals	Thomas L. Floyd	11/e, Pearson Education,, 2017
2	Fundamentals of Digital Logic with Verilog Design	Stephen Brown & Zvonko Vranesic	3/e, McGraw Hill Education, 2013
3	Fundamentals of Logic Design	Charles H. Roth Jr.	7/e, Cengage Learning India Private Limited, 2024

Reference			
Sl. No.	Title of Book	Author	Publication
1	Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog	M Morris Mano, Michael D. Ciletti	6/e, Pearson India , 2018
2	Fundamentals of Digital Circuits	A. Ananthakumar	4/e, PHI , 2016
3	Introduction to Logic Circuits & Logic Design with Verilog	Brock J. LaMeres	2/e, Springer, 2019
4	Digital Design Verilog HDL and Fundamentals	Joseph Cavanagh	1/e, CRC Press, 2008
5	Verilog HDL	Samir Palnitkar	2/e, Pearson India, 2006
6	A Verilog HDL Primer	J Bhasker	3/e, Star Galaxy Publishing, , 2018

COURSE DESCRIPTION							
REGULATION	2025	L-T-J-P-S	2-1-1-0-4	VERSION	25/0	CREDITS	4
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B250004/EC320D	SEMICONDUCTOR DEVICE THEORY	PCB
PRE-REQUISITE		
B250802/PH910B - Physics for Electrical Science (Semiconductor fundamentals), B250906/CN100D - Introduction to Electrical and Electronics Engineering		

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme						
L	T	J	P	S			Theory			Practical			Total
					CIA	ESE	Total	CIA	ESE	Total			
2	1	1	0	4	120	C	CIA	ESE	Total	CIA	ESE	Total	100
						4	60	40	100	-	-	-	
<i>L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination</i>													

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Advanced Carrier Transport and Excess carriers in semiconductors	Generation and recombination mechanisms of excess carriers; quasi-Fermi levels ; Carrier transport in semiconductors; Hall Effect; Einstein relations; Poisson equations; Continuity equations.	15
2	Electrical Properties and Breakdown Mechanisms of p-n Junction Diodes, BJTs	P-N Junction Under Bias; Diode Current Characteristics: ideal and practical diode behaviour; Breakdown Mechanisms; BJT: Energy band diagram, minority carrier distribution, current components.	12
3	MOS Capacitor and MOSFET drain current equation	Metal oxide semiconductor junction; Ideal MOS capacitor; CV characteristics; MOSFET- Operation and Drain characteristics of enhancement type MOSFET.	10
4	MOSFET scaling and short channel effects.	MOSFET scaling; Need for scaling, constant voltage scaling and constant field scaling; Sub- threshold conduction in MOS; Short channel effects in MOSFETs. Advanced semiconductor device structures : MESFET, FINFET,HEMT, TFET	8

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1.	Semiconductor Physics and Devices	Donald A. Neamen	4/e, McGraw-Hill, 2021
2.	Solid State Electronic Devices	Ben G. Streetman, Sanjay Banerjee	7/e, Pearson
3.	Physics of Semiconductor Devices	S.M. Sze, Kwok K. Ng	4/e, Wiley, 2021

Reference			
Sl. No.	Title of Book	Author	Publication
1.	Principles of Semiconductor Devices	Sima Dimitrijevic	2/e, Oxford University Press, 2011
2.	Electronic Devices and Circuits	J.B. Gupta	6/e, Katson Publishers (India), 2016
3.	Electronic Devices	Thomas L. Floyd	9/e, Pearson, 2021
4.	Fundamentals of Semiconductor Devices	M.K. Achuthan & K.N. Bhatt	2/e, McGraw-Hill, 2017
5.	Introduction to Semiconductor Materials and Devices	M.S. Tyagi	John Wiley & Sons, 2004
6.	Fundamentals of Semiconductor Devices	B.L. Anderson & R.L. Anderson	2/e, McGraw-Hill, 2017

COURSE DESCRIPTION							
REGULATION	2025	L-T-J-P-S	(3-0-0-0-5)	VERSION	25/0	CREDITS	4
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B250902/CN300E	INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	EST
PRE-REQUISITE		
<ul style="list-style-type: none"> Basic knowledge of Engineering Mathematics (linear algebra, matrices, basic probability concepts) Fundamentals of Programming (preferably Python or any high-level language) Understanding of basic statistics (mean, variance, distributions) 		

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme						
L	T	J	P	S			Theory			Practical			Total
					C	CIA	ESE	Total	CIA	ESE	Total		
3	0	0	0	5	120	4	60	40	100				100
<i>L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination</i>													

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Foundations of AI, ML, and Data Science	Overview of AI, ML, and Data Science, Data types, Feature representation and feature engineering basics, Data pre-processing, Machine Learning workflow, Evaluation Metrics, Bias Variance Trade-off, Types of ML, Ethics in AI and data privacy	10
2	Mathematical Foundations for Machine Learning and data science	Vectors and matrices in data representation, Matrix operations, norms, and distance/similarity measures, Orthogonality and Gram-Schmidt process, Eigenvalues and eigenvectors, Spectral decomposition and Singular Value Decomposition, Principal Component Analysis (PCA) and dimensionality reduction.	12
3	Supervised Learning and Neural Networks	Supervised learning framework and evaluation metrics, Regression and Classification concepts, Linear Regression, Logistic Regression, Introduction to Classification and Bayesian Classifiers, Support Vector Machines, Introduction to Neural Networks, Perceptron model and learning rule, Multi-Layer Perceptron (MLP) and backpropagation, Overview of Deep Learning.	13
4	Unsupervised Learning and Data Science Workflow	Unsupervised learning concepts and applications, K-means clustering and cluster evaluation, Exploratory Data Analysis (EDA) and visualization, Statistical measures: mean, variance, distributions, Maximum Likelihood Estimation (MLE), Data Science lifecycle, Tools introduction: Python, NumPy, Pandas, basic visualisation.	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson, 4/e
2	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer, 1/e
3	Introduction to Machine Learning with Python	Andreas C. Müller, Sarah Guido	O'Reilly, 1/e
4	Data Science for Engineers	R. K. Jain, P. K. Singh	McGraw Hill, 1/e

Reference			
Sl. No.	Title of Book	Author	Publication
1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly, 3/e
2	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press, 1/e
3	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer, 2/e
4	Applied Linear Algebra and Matrix Analysis	Thomas S. Shores	Springer, 2/e
5	Python for Data Analysis	Wes McKinney	O'Reilly, 3/e

COURSE DESCRIPTION							
REGULATION	2025	L-T-J-P-S	2-1-0-0-1	VERSION	25/0	CREDITS	2
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B250908/HU900F	ENGINEERING ECONOMICS	HMT
PRE-REQUISITE		
There are no prerequisites for taking this course.		

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme						Total
							Theory			Practical			
L	T	J	P	S	60	C	CIA	ESE	Total	CIA	ESE	Total	100
2	1	0	0	1			2	60	40	100	-	-	
<i>L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination</i>													

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Economic Foundations for Engineering Decision-Making	Introduction to Economics, Demand and Supply Analysis, Elasticity of Demand, Market Structures Relevant topics from Text 1,2 & 3	6
2	Production Economics	Cost and Revenue Analysis, Break Even and Decision Analysis, Equipment Replacement Analysis Relevant topics from Text 4,5 & 6	8
3	Investment Decision Techniques	Introduction to Capital Budgeting, Non-Discounted Techniques, Discounted Techniques - Evaluation Methods and Economic Comparison Methods Relevant topics from Text 7 & 8	8
4	Project Economics, Sustainability & Contemporary Engineering Decisions	Project Economic Analysis & Public Sector Decisions, Life Cycle Cost Analysis Relevant topics from Text 6,7, 9 & 10.	8

SUGGESTED LEARNING RESOURCES			
Text Book			
Sl. No.	Title of Book	Author	Publication
1	Macro-Economic Theory and Policy	D. N. Dwivedi	McGraw Hill
2	Principles of Macroeconomics	N. Gregory Mankiw	Cengage
3	Principles of Economics	N. Gregory Mankiw	Cengage
4	Managerial Economics	D. N. Dwivedi	Vikas Publishing House
5	Engineering Economics	R. Panneerselvam	PHI Learning
6	Engineering Economy	William G. Sullivan, Elin M. Wicks & C. Patrick Koelling	Pearson
7	Engineering Economy	Leland Blank & Anthony Tarquin	McGraw Hill
8	Financial Management	Prasanna Chandra	Tata McGraw Hill
9	Macroeconomic Theory	M. L. Jhingan	Vrinda Publications
10	Sustainable Engineering: Concepts, Design and Case Studies	David T. Allen & David R. Shonnard	Pearson-Prentice Hall

Reference			
Sl. No.	Title of Book	Author	Publication
1	Contemporary Engineering Economics	Chan S. Park	Pearson-Prentice Hall

2	Principles of Engineering Economy	Eugene L. Grant, W. Grant Ireson & Richard S. Leavenworth	Wiley
3	Economic Analysis of Investment Projects	World Bank Group	World Bank Publications
4	LCOE and Renewable Energy Economics in India	NITI Aayog or MNRE	NITI Aayog or MNRE Publications

COURSE DESCRIPTION							
REGULATION	2025	L-T-J-P-S	3-0-0-0-1	VERSION	25/0	CREDITS	2
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B250908CN900F	MANAGEMENT FOR ENGINEERS	HMT
PRE-REQUISITE		
NIL		

TEACHING AND ASSESSMENT SCHEME										
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme			Total
L	T	J	P	S	30	C	Theory			
3	0	0	0	1		2	CIA	ESE	Total	
							60	40	100	100

L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination

SYLLABUS			
Module	Title	Major Topics	Hrs
1	Foundations of Management & Contemporary Thinking	Evolution & Functions of Management, Planning, Organising, Controlling, Contemporary Strategy	11
2	Human Resource Management, Leadership & Organisational Behaviour	Human Resource Management, Motivation, Leadership, Organisational Behaviour, Change Management	9
3	Decisions – Making	Quantitative Techniques for Decisions, Network Diagrams – CPM, PERT	9
4	Operations, Strategy & Entrepreneurship	Operations and Quality Management, Project Management and Agile Methods	7

SUGGESTED LEARNING RESOURCES

Text Books			
Sl. No.	Title of Book	Author	Publication
1	Essentials of Management	Koontz, H. & Weihrich, H	McGraw Hill, 11 th Edition
2	Management	Robbins, S.P. & Coulter, M	Pearson Education, 14 th Edition
3	Financial Management: Theory and Practice	Prasanna Chandra	McGraw Hill, 11 th Edition

Reference			
Sl. No.	Title of Book	Author	Publication
1	Blue Ocean Strategy	Kim, W.C. & Mauborgne, R.	Harvard Business Review Press, 2004
2	The Lean Start-up	Ries, E.	Crown Business, 2011
3	Change by Design	Brown, T.	Harper Business, 2019

COURSE DESCRIPTION							
REGULATION	2025	L-T-J-P-S	3-1-0-0-4	VERSION	25/0	CREDITS	4
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
-	FUNDAMENTALS OF CYBER-PHYSICAL SYSTEM	MINOR
PRE-REQUISITE		
NIL		

TEACHING AND ASSESSMENT SCHEME												
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme					
L	T	J	P	S			Theory			Practical		
CIA	ESE	Total	CIA	ESE	Total							
3	1	0	0	4	120	4	Students are required to enroll for a MOOC course offered by NPTEL and the grade obtained for that course shall be taken as the credit obtained for this course.-					
<p>L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination</p>												

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Introduction to CPS, IoT and Smart Automation	Cyber-Physical Systems, Internet of Things and Industry 4.0: basic concepts, motivation and applications; relation between physical systems, sensing, computation, communication and actuation; smart systems in civil infrastructure, mechanical systems, electrical systems, healthcare, agriculture, transportation and industrial automation; basic architecture of CPS/IoT/smart automation systems.	15
2	Sensors, Actuators, Devices and Connectivity	Sensors and actuators: basic role and examples; temperature, pressure, level, flow, vibration, motion, proximity, image and environmental sensors; actuators used in smart systems; microcontrollers, embedded boards, edge devices and IoT nodes; basic idea of data acquisition and sampling; wired and wireless connectivity; Wi-Fi, Bluetooth, ZigBee, LoRa, cellular and industrial communication; latency, bandwidth, reliability and power consumption at an introductory level.	15
3	Monitoring, Control and Automation	Need for monitoring, feedback and automation; simple block-diagram representation of smart systems; open-loop and closed-loop systems using simple examples; basic idea of real-time response, delay and scheduling; examples such as water-level control, temperature control, motor-speed control, smart irrigation, traffic signal control, building automation, structural health monitoring and industrial process monitoring.	15
4	Data, Cloud, Intelligence, Safety and Security	Role of data in smart connected systems; cloud, edge and fog computing; dashboards, alerts and remote monitoring; introductory role of AI/ML in prediction, fault detection and decision-making; basic idea of digital twins and Industry 4.0 applications; safety issues in automated systems; cyber-security concerns in sensing, communication, computation and actuation; examples of false data, communication failure, unauthorized access and need for resilient operation.	15

EQUIVALENT MOOC COURSES

Sl No	Course Name	Offering Agency	Institution	Faculty
1	Foundations of Cyber Physical Systems	NPTEL	IIT Kharagpur	Prof. Soumyajit Dey

2	Introduction to Internet of Things	NPTEL	IIT Kharagpur	Prof. Sudip Misra
3	Introduction to Industry 4.0 and Industrial Internet of Things	NPTEL	IIT Kharagpur	Prof. Sudip Misra

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Introduction to Cyber-Physical Systems	Rajeev Alur	MIT Press, 2015
2	Internet of Things: Architecture and Design Principles	Raj Kamal	McGraw Hill Education, 2017

Reference			
Sl. No.	Title of Book	Author	Publication
1	Internet of Things: Architecture and Design Principles	Raj Kamal	McGraw Hill Education India, 2nd Edition, 2022
2	Internet of Things: A Hands-on Approach	Arshdeep Bahga and Vijay Madisetti	Universities Press India, 2015
3	Industry 4.0: The Industrial Internet of Things	Alasdair Gilchrist	Apress, 2016
