



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)



B. Tech. Scheme of Examination & Syllabus 2025 - 26 ELECTRONICS & TELECOMMUNICATION ENGINEERING

SEMESTER V III

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				Minimum Passing Marks	No of Hours for ESE
				L	T	P		Mid-Sem Examination	Continual Assessment	End Sem Examination	Total		
1.	PCC	25ET301T	Microprocessors and Interfacing	3	-	-	3	20	20	60	100	45	3
2.	PCC	25ET301P	Microprocessors and Interfacing Lab	-	-	2	1	-	25	25	50	25	-
3.	PCC	25ET302T	Problem Solving Using Python	3	-	-	3	20	20	60	100	45	3
4.	PCC	25ET302P	Problem Solving Using Python Lab	-	-	2	1	-	25	25	50	25	-
5.	PCC	25ET303T	Sensors and Actuators	2	-	-	2	10	10	30	50	23	1.5
6.	PCC	25ET304T	Signals and Systems	3	-	-	3	20	20	60	100	45	3
7.	VEC	25ET305T	Environmental Science	2	-	-	2	10	10	30	50	23	1.5
8.	HSSM	25ET306T	Fundamentals of Economics and Management	2	-	-	2	10	10	30	50	23	1.5
9.	SEC	25ET341P	Career Development -I	-	-	2	1	-	50	-	50	25	-
10.	MDM	25ET331M	MDM - I (Refer MDM basket)	2	-	-	2	10	10	30	50	23	1.5
Total				17	-	6	20	100	200	350	650	302	-

Multidisciplinary Minor - I

25ET331M	Introduction to Semiconductor Devices
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ELECTRONICS AND TELECOMMUNICATIONS

Third Semester

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25ET301T	Microprocessor and Interfacing	3	-	-	3	20	20	60	100
Course Objectives					Course Outcomes				
1. To understand the fundamentals of microprocessors and embedded systems. 2. To learn architecture and programming of the Intel 8086 microprocessor. 3. To understand interfacing of memory and peripheral devices. 4. To study architecture and applications of the 8051 microcontrollers.					Students will be able to: 1. Explain architecture and operation of 8086 microprocessor. 2. Develop assembly language programs using instruction sets and addressing modes. 3. Interface memory and peripheral devices with microprocessor systems. 4. Describe architecture and features of 8051 microcontroller. 5. Develop programs using assembly and Embedded C for 8051.				

Unit I: Microprocessor Fundamentals & 8086	[09 Hrs.]
Introduction to Microprocessors and Embedded Systems, Evolution of Microprocessors, Bus structure and system organization, Overview of Intel 8086 microprocessor, Architecture and register organization, Segmentation and memory organization, Pin configuration, Minimum and Maximum modes, Stack organization, Interrupts and Interrupt Service Routines (ISR), Basic timing diagrams.	
Unit II: 8086 Programming & Interfacing	[09 Hrs.]
8086 Addressing modes and instruction set, Assembly language programming, Stack operations and subroutines, Assembler directives, Modular programming techniques, Memory interfacing concepts, Case studies.	
Unit III: Introduction to Microcontrollers	[09 Hrs.]
Introduction to microcontrollers and embedded systems, Architecture of 8051 microcontroller, Pin diagram and functional blocks, Memory organization and interfacing concepts, Serial communication fundamentals, Interrupt structure and priority levels.	
Unit IV: 8051 Programming & Embedded C	[09 Hrs.]
8051 Instruction set and addressing modes, Assembly language programming examples, Introduction to Embedded C programming, GPIO programming, Interrupt handling.	
Unit V : 8051 Interfacing & Applications	[09 Hrs.]
8051 Timers and Counters programming in different modes, Serial communication and baud rate generation, Interfacing techniques: keyboard, LED display, ADC, DAC, and stepper motor, Embedded C programming for real-time applications, Case study	

Text Books

S. N.	Title	Authors	Edition	Publisher
1	Microprocessor Architecture, Programming and Applications with 8085	Ramesh S. Gaonkar	Latest	Penram International
2	Advanced Microprocessors and Peripherals	A. K. Ray, K. M. Bhurchandi	Latest	McGraw-Hill Education (India)
3	The 8051 Microcontroller and Embedded Systems	M.A. Mazidi, J.G. Mazidi, R.D.	Latest	Pearson

Reference Books / Resources

S. N.	Title	Authors	Edition	Publisher
1	The AVR Microcontroller and Embedded Systems: Using Assembly and C	M.A. Mazidi, S. Naimi, S. Naimi	Latest	Prentice Hall
2	Online Resource: NPTEL – Microprocessors and Microcontrollers	IIT Faculty (NPTEL)	Latest	National Programme on Technology Enhanced Learning

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ELECTRONICS AND TELECOMMUNICATION ENGINEERING

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25ET301P	Microprocessor and Interfacing Lab	-	-	2	1	-	25	25	50
Course Objectives					Course Outcomes				
1. To provide hands-on experience in assembly language programming using 8086 microprocessor and 8051 microcontrollers. 2. To develop the ability to design, analyze, and interface memory and peripheral devices with microprocessor-based systems.					Students will be able to: 1. Apply assembly language programming for arithmetic, logical, and data manipulation operations using 8086 and 8051 2. Analyze and verify microprocessor-based programs and system operations 3. Design and implement interfacing of memory and peripheral devices with microprocessor systems 4. Interpret program results and demonstrate proper use of				

List of Practicals:

S. No.	Description
1	Introduction to microprocessor trainer kit/simulator (8086) and study of basic assembly language program structure
2	Write and execute 8086 assembly language programs for addition and subtraction of 8-bit and 16-bit numbers
3	Write and execute 8086 assembly language programs for multiplication and division of 16-bit numbers
4	Write and execute 8086 assembly language programs to compare two strings
5	Write and execute 8086 assembly language programs to arrange data bytes in ascending/descending order
6	Study and implementation of memory interfacing concepts using 8086 (address decoding)
7	Write and execute 8051 assembly language programs for data operations (e.g., smallest number, data exchange)
8	Interface 8255 with 8086 and write a program for LED interfacing
9	Interface 8255 with 8086 and write a program to control stepper motor rotation
10	Interface 8255 with 8086 and generate square waveform using timer

Text Books

S. N.	Title	Authors	Edition	Publisher
1	Microprocessor Architecture, Programming and Applications with 8085	Ramesh S. Gaonkar	2	Penram International
2	Advanced Microprocessors and Peripherals	A. K. Ray, K. M. Bhurchandi	1	McGraw-Hill Education (India)
3	The 8051 Microcontroller and Embedded Systems	M.A. Mazidi, J.G. Mazidi, R.D.	Latest	Pearson

Reference Books / Resources

S. N.	Title	Authors	Edition	Publisher
1	The AVR Microcontroller and Embedded Systems: Using Assembly and C	M.A. Mazidi, S. Naimi, S. Naimi	Latest	Prentice Hall
2	Online Resource: NPTEL – Microprocessors and Microcontrollers	IIT Faculty (NPTEL)	Latest	National Programme on Technology Enhanced Learning

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25ET302T	Problem Solving Using Python	3	-	-	3		20	60	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To introduce fundamental concepts of algorithmic problem-solving and basic programming constructs using Python. To develop proficiency in Python programming by implementing conditionals, loops, functions, and object-oriented programming concepts. To apply file handling, exception handling, and recent Python libraries for real-world problem-solving. 	<p>After completion of the course students are able to,</p> <ol style="list-style-type: none"> Develop algorithmic solutions using pseudo-code and flowcharts, applying iteration and recursion techniques. Demonstrate the use of Python's modules for problem-solving. Implement conditionals, loops, and function-based programming, including recursion and string manipulations. Analyze dictionaries, list comprehensions, and object-oriented programming concepts such as inheritance and polymorphism. Apply file handling and exception handling techniques in Python and explore the basics of Pandas and recent trends in Python.

Unit I:	[10Hrs]
Algorithmic Problem Solving: Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).	
Unit II:	[10Hrs]
Python interpreter and interactive mode: values and types: int, float, Boolean, string, and list; variables, expressions, statements, Tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments	
Unit III:	[9Hrs]
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices	
Unit IV:	[9Hrs]
Dictionaries: operations and methods; advanced list processing – list comprehension; Object Oriented Programming: Classes and objects-inheritance, polymorphism.	
Unit V	[7Hrs]
File Handling and Exception Handling: Overview of exception classes and Types: try, except, finally: File processing: reading and Writing files, Introduction to Pandas, Recent Trends in Python,	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Python Programming using problem solving Approach,	Reema Theraja,	1	Oxford University Press
2	A Byte of Python By	C. H. Swaroop,	2014	GitBook

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Python: The Complete Reference	Martin C. Brown	--	Mc. Graw Hill Education.

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credit	Evaluation			
						MSE	CA	ESE	Total
25ET302P	Problem solving using Python Lab	--	-	2	1	-	25	25	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none">1. Develop Practical Coding Skills: Enable students to gain hands-on experience in writing and executing Python programs2. Apply Problem-Solving Techniques: Encourage students to use Python to solve real-world problems by applying control structures, data structures, and functions.3. Introduce Advanced Python Concepts such as object-oriented programming, regular expressions, and data visualization, preparing them for practical applications in their field.	<p>After completion of the course students are able to,</p> <ol style="list-style-type: none">1. To write and execute Python programs demonstrating correct usage of basic syntax, data types, and operators.2. To demonstrate the ability to implement control structures such as loops and conditional statements to solve problems efficiently.3. To adept at defining and calling functions, passing arguments, and returning values, as well as creating and using Python modules for modular programming.4. To create and manipulate fundamental data structures and applying them to solve practical problems.5. To demonstrate an understanding programming tasks and real-world applications.

Sr.NO	List of the experiment
1	Writing simple programs to demonstrate basic syntax and data types.
2	Practice programs for input/output operations and type conversions.
3	Programs to demonstrate control structures
4	Programs to demonstrate loops.
5	Writing functions for various mathematical and logical operations.
6	Creating and using modules in Python.
7	Programs to manipulate strings and use string methods.
8	Creating and manipulating lists, tuples, dictionaries, and sets.
9	Real-world applications of data structures in solving problems.
10	Creating classes and objects, and implementing OOP concepts.
11	Writing programs for file handling and exception management.
12	Using regular expressions to search and manipulate text.

Books and References

S.N	Title	Authors	Edition	Publisher
1	Python: The Complete Reference	Martin C. Brown	-	Mc. Graw Hill Education.

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25ET303T	Sensors & Actuators	2	-	-	2	20	20	60	100
Course Objectives					Course Outcomes				
1. Understand basics of sensors, transducers, and measurement systems. 2. Study various types of sensors and their applications. 3. Learn about actuators and sensor-actuator integration.					Students are able to, 1. Explain sensor principles and characteristics. 2. Identify and apply suitable sensors for various domains. 3. Describe actuator types and sensor-actuator systems				

Unit 1 : Basics of Sensors and Transducers	[8Hrs]
Introduction to Sensors and Transducers, Sensor Characteristics, Generalized Measurement System, Transduction Principle	
UNIT 2: Different Types of Sensors and Their Applications	[12 Hrs]
Mechanical and Displacement Sensors, Temperature and Pressure Sensors, Light and Optical Sensors, Magnetic and Proximity Sensors, Agricultural Sensors, Special Sensors, Application Domains, Smart sensors	
UNIT 3: Actuators and Their Applications	[10 Hrs]
Introduction to Actuators, Non-Electrical Actuators, Micro and Smart Actuators, Sensor-Actuator Integration & Applications	

Text Books

S.N	Title	Authors	Edition	Publisher
1	A course in Electrical and Electronics Measurements and Instrumentation	A. K. Sawhney	17	Dhanpat Rai & Co.
2	Sensors and Transducers	D. Patranabis	2	PHI

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Instrumentation Measurement and Analysis	B.C. Nakra and K.K. Chaudhry	4	McGraw Hill

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25ET304T	Signals and Systems	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To introduce students to the fundamentals of continuous time signals, their classifications, representations, and basic operations. To develop the ability to analyze linear time-invariant systems using convolution, differential equations, impulse response, and block diagram models. To impart knowledge of frequency-domain techniques such as Fourier Series, Fourier Transform, and Laplace Transform for signal and system analysis. To enable students to understand sampling theory, reconstruction methods, aliasing effects, and their applications in signal processing. 	<p>After completion of the course students will be able to,</p> <ol style="list-style-type: none"> Define and classify signals along with their mathematical representation and perform basic operations on signals Analyze continuous-time LTI systems using convolution, system properties, interconnections, impulse response, step response, and differential equation models. Analyze periodic and aperiodic signals using Fourier Series and Fourier Transform Solve engineering problems using unilateral and bilateral Laplace Transforms, determine inverse transforms, and analyze system behaviour in the s-domain. Interpret sampling and reconstruction processes, apply sampling theorem, analyze aliasing effects.

Unit I: SIGNALS	[8Hrs]
Basics of Signals & Systems: Introduction, Continuous-Time and Discrete-Time Signals, Examples and Mathematical Representation, Classification of signals, Basic Operations on Signals, Elementary Signals	
Unit II: SYSTEMS	[8Hrs]
Continuous-Time LTI Systems: Classification of Systems, The Convolution Integral, Properties of LTI Systems, interconnection of systems in series / parallel, Relations between LTI system properties and impulse response, Step response, Causal LTI Systems Described by Differential Equations, Block Diagram Representations of First-Order Systems	
Unit -III FOURIER SERIES & FOURIER TRANSFORM	[8Hrs]
Fourier Series representation of periodic signals: Trigonometric Form and Exponential Form, Fourier Series Representation of Continuous-Time Periodic Signals, Representation of Aperiodic Signals: The Continuous-Time Fourier Transform, The Fourier Transform for Periodic Signals, Properties of the Fourier Transform, The Magnitude-Phase Representation of the Fourier Transform of LTI Systems	
UNIT- IV: LAPLACE TRANSFORM	[8Hrs]
Introduction to Laplace Transform and its significance in signal analysis, Definition of One-Sided and Two-Sided Laplace Transform, Conditions for existence of Laplace Transform, poles and zeros, the Region of Convergence, Laplace Transform of standard signals, Properties of Laplace Transform, Inverse Laplace Transform using partial fraction method.	
Unit -V: SAMPLING THEORY	[8 Hrs]
Introduction, Representation of a Continuous-Time Signal by Its Samples, The Sampling Theorem-Impulse Train Sampling, Nyquist rate of sampling, Sampling with a Zero- Order Hold , Reconstruction of a Signal from Its Samples Using Interpolation, Effect of Under sampling: Aliasing, Anti-Aliasing filter,	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Signals and Systems	Alan V. Oppenheim, Alan S.Willsky	2	PHI
2	Signals and Systems	Simon Haykin, Barry Van Veen	2	Wiley
3	Signals and Systems	A. Anand Kumar	1	PHI

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Linear Systems & Signals	B.P. Lathi	2	Oxford University Press, 2004
2	Signals, Systems and Transforms	Charles Phillips	3	Pearson
3	Fundamentals of Signals and Systems	Michel J. Robert	--	MGH International

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ELECTRONICS AND TELECOMMUNICATIONS

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25ET305T	Environmental Sciences	2	-	-	2	10	10	30	50

Course Objectives	Course Outcomes
This course is intended 1. To provide knowledge of natural resources, their classification, utilization, and the importance of conservation for sustainable development. 2. To create awareness about climate change issues such as global warming, ozone depletion, acid rain, and their environmental impacts along with mitigation strategies. 3. To introduce the fundamental concepts of Sustainable Science and promote awareness of eco-friendly technologies	Students will be able to 1. Describe natural resources, their classification, and the importance of conservation, including the role of individuals and public awareness in sustainable resource management. 2. Analyze climate change and assess their environmental impacts and mitigation strategies. 3. Examine different types of environmental pollution, their causes, effects, and control measures, along with solid waste management practices and disaster management techniques. 4. Apply concepts of sustainable practices to evaluate environmentally friendly materials, processes, and technologies in engineering applications

UNIT I – Natural Resources & Climate Changes [10 Hrs.]

Natural Resources- Definition, scope and importance; Need for public awareness -Institutions in environment, people in environment. Renewable and non-renewable and associated problems; Role of an individual in conservation of natural resources; equitable use of resources for sustainable lifestyles. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. **Climate Changes** Global warming and greenhouse effect, Climate change impacts and mitigation strategies.

UNIT II - Environmental Pollution [10 Hrs.]



Definition Cause, effects and control measures of a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. **Solid waste Management:** Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. **Disaster management:** floods, earthquake, cyclone and landslides, Ozone layer depletion, Acid rain.

UNIT II – Sustainable Science [10 Hrs.]

Introduction, Principles of Green Chemistry with example, Green Reagents- Super Critical Fluid (CO₂)- Properties and Applications, Green Building-Introduction, Components, Reuse and safety of building material and its environmental impact., Green Crackers- Introduction, Advantages. Carbon Credit, Carbon Sequestration, Carbon Capture and Storage CCS.

Reference Books-

S.N	Title	Authors	Edition	Publisher
1	Environmental Problems and solutions	D.K.Asthana, Mira Asthana		S.Chand.
2	Bio-Diversity	M.S.Swaminathan		Macmillan India Ltd.
3	Essentials of Ecology & Environmental Science	Rana		Prentice Hall of India
4	Environmental Chemistry	A.K.De		New Age International
5	Environmental Pollution Monitoring & Control	Khopkar S. M.		New Age International

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25ET306T	Fundamentals of Economics and Management	2	-	-	2	10	10	30	50

Course Objectives	Course Outcomes
1. The course examines how the economics, business and industrial management practices are related and how business decision is taken.	Students will be able to: 1. Apply economic principles for business decisions by understanding production cost relationships 2. Assess impact of macroeconomics and government policies on business and economy. 3. Recognize key management, marketing, and financial functions and their role in effective business decision-making

Unit I	[10Hrs]
Economics, Classification of economics, Industrial economics, Consumer demand, Law of Demand, Determinants of demand, Demand forecasting, Law of supply, Types of Elasticity of demand, Concept of Production, Factors of Production, types of cost, cost curves.	

Unit II	[10Hrs]
Market Structures: Perfect competition, Monopoly, and Monopolistic competition, Functions of central bank, Inflation, Deflation, Recession, National income, GDP, GNP, Liberalization, Privatization and Globalization	

Unit III	[10Hrs]
Definition of management, functions of management, Functions of human resources Management, Marketing Management, Functions of Marketing Management. Methods of pricing, advertising and sales promotion. Financial Management, functions of financial management, Sources of finance.	

Text Books

S. N	Title	Authors	Edition	Publisher
1.	Managerial Economics	D.N. Dwivedi	8th	Vikas Publishing
2.	Modern Economic Theory	K.K. Dewett	2005	S. Chand Publisher
3.	Industrial Management	Dr.I.K. Chopde, Dr.A.M. Sheikh	Revised edition	S. Chand Publisher

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Industrial Organization and Industrial economics	T.R. Banga, S.C. Sharma	2006	Khanna Publishers

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Branch name

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25CE341P	Career Development - I	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
To develop students' quantitative aptitude, logical reasoning, verbal communication, critical thinking, self-management, and professional employability skills required for academic success, competitive examinations, and workplace readiness.	<p>CO1. Students will be able to solve problems related to number systems, logical series, equations, ratios, proportions, and arrangement-based reasoning with accuracy and logical understanding.</p> <p>CO2. Students will be able to apply concepts of percentage, partnership, profit and loss, discount, simple interest, and compound interest to solve practical and business-oriented numerical problems.</p> <p>CO3. Students will be able to perform SWOC analysis, formulate SMART goals, and demonstrate professional verbal communication skills in workplace environments.</p> <p>CO4. Students will be able to construct logical arguments, participate effectively in debates, and deliver coordinated group presentations with confidence and clarity.</p> <p>CO5. Students will be able to demonstrate proficiency in grammar, vocabulary, reading comprehension, and professional communication while exhibiting consistent participation, individual responsibility, collaborative teamwork, and professional classroom conduct.</p>

Unit I (10 marks)	[7Hrs]
Number System: - Divisibility Test, LCM/HCF Problems, Factorization, Successive Division, Number Series:- Missing Number Series, Wrong Number series, Letter Series, Analogy (Number, Letter, Word, Non Verbal analogy), Simple Equations :- Two digit, 3 digit, ages and puzzles questions, Ratio & Proportion:- Joining of two ratios, Proportion, Mean Proportions, Problems on ages Linear, circular Arrangement	
Unit II (15 marks)	[7Hrs]
Percentage: - Percentage to ratio conversion, Successive Percentage, Increase Decrease of Percentage, etc. Partnership Problems, Profit Loss:- Concept of Profit loss, Relation between CP ,SP Profit and Loss, Problems on Profit Loss. Discount:- Successive Discount, Relation between MP Discount and Selling Price, Problems based on Discount, Simple Interest, Compound Interest	
Unit III (5 marks)	[5Hrs]
SWOC Analysis and SMART Goal Setting for Personal and Professional Development Corporate Communication I – Professional Verbal Communication in Workplace Environments-	
Unit IV (10 marks)	[6Hrs]
Debating Skills – Logical Thinking, Argument Building, and Public Speaking Group Presentation Skills – Team Coordination, Public Speaking, and Presentation Techniques	
Unit V (10 marks)	[3Hrs]
Verbal Ability Quiz – Grammar, Vocabulary Building, and Reading Comprehension for Professional Communication Continuous Assessment - Attendance, Individual Engagement & Team Dynamics	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude By R. S. Aggarwal	R.S. Aggarwal		
2	Quantitative Aptitude	Shripad Deo		Allied Publishers Pvt Ltd
3	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Aggarwal		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude for CAT by Arun Sharma	Arun Sharma		
2	How to Develop Self-Confidence & Influence People by Public Speaking	Dale Carneige	2004	Sulabh Publications
3	Professional Communication Skills	Alok Jain	2006	S Chand & Company Ltd
4	Soft Skills & Employability Skills	Sabina Pillai	2008	Cambridge

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ELECTRONICS AND TELECOMMUNICATION ENGINEERING

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25ET331M	MDM – I Introduction to Semiconductor Devices	2	-	-	2	20	20	60	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> Understand semiconductor materials and carrier transport mechanisms. Analyze the operation of PN junctions, diodes, and MOS devices. Study MOSFET characteristics, scaling, and modern transistor technologies. Explore the principles and applications of optoelectronic devices. 	<p>After successful completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> Explain semiconductor fundamentals, energy band theory, and carrier transport mechanisms. Analyze the characteristics and operation of PN junctions and semiconductor diodes. Evaluate the operation, characteristics, and performance of MOS capacitors and MOSFETs. Interpret the impact of technology scaling, short-channel effects, and modern transistor structures. Explain the working principles and applications of photodetectors, solar cells, LEDs, and laser diodes.

Description

Week-1 : Semiconductors in daily life, semiconducting material properties, energy levels in atoms, energy band formation, bandgap and material classification, electrons and holes, effective mass

Week-2 : Carrier properties – intrinsic carrier density, Fermi level, donor and acceptor impurities, Fermi level in extrinsic semiconductors, temperature dependence of carrier density, generation and recombination of carriers

Week-3 : Thermal motion of carriers, carriers under electric field, mobility and drift current, diffusion of carriers, general expression for current in a semiconductor, energy bands under electric fields

Week-4 : pn junction electrostatics, fixed and free charge, depletion approximation, electric field at the junction, built-in potential, step junction vs linearly graded junction, energy band diagram of a PN Junction and quasi-Fermi levels

Week-5 : pn junction under applied bias, minority carrier injection and spatial variation in depletion and quasi-neutral regions, band-bending under applied bias, ideal diode equation

Week-6 : Diode non-idealities, breakdown, depletion and diffusion capacitance, p-i-n Diode, Metal Semiconductor Junctions

Week-7 : Ideal MOS capacitor structure, Qualitative analysis of field effect, block charge, electric field and potential diagrams, energy band diagrams, Accumulation and inversion regimes, Gate voltage drop across a MOS device

Week-8 : Threshold voltage of a MOS device, Capacitance-Voltage (CV) measurements, HFCV and LFCV of a MOS capacitor, Non-idealities in a MOS capacitor – work function difference and flatband voltage, tunneling over gate barrier and leakage current, high-k gate dielectrics

Week-9 : Long Channel MOSFETs, energy band diagram and qualitative understanding of MOSFET operation, IDVD and ID-VG relationships, square law theory of MOSFET, sub-threshold slope, performance metrics of a MOSFET

Week-10: Technology scaling and Moore's law, qualitative understanding of Short channel effects – velocity saturation, channel length modulation, drain induced barrier lowering (DIBL), differences in IV characteristics of long and short channel MOSFETs, overview of modern FETs (FinFETs, tunnel FETs and nanowire transistors)

Week-11: Optoelectronic devices in daily life, III-V Semiconductors, direct and indirect bandgaps, optical absorption, pin photodetectors, solar cells, open circuit voltage and short circuit current

Week-12: Light emitting devices – Heterostructures, LEDs and their luminescent efficiency, double heterostructure and population inversion, diode lasers, LI characteristics and threshold current

S.N	Title	Authors	Edition	Publisher
1	Semiconductor physics and devices: basic principles	Neamen, Donald A		McGraw-Hill,
2	Semiconductor Device Fundamentals,	R. F. Pierret		Prentice-Hall, 1996.

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