Department of Electronics & Communications Engineering

Andhra University College of Engineering

Visakhapatnam-530003

4 Years B.TECH

Programme Code: 3-1-12

and

B.TECH+M.TECH (DOUBLE DEGREE COURSE)

Programme Code: 3-5-07

Scheme of Instruction and Examination with effect from 2022-2023 admitted batch onwards

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
A U COLLEGE OF ENGINEERING
ANDHRA UNIVERSITY
SCHEME AND SYLLABI
(with effect from 2022-23 admitted Batch)

B.Tech & B.Tech+M.Tech
I Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC1101	BS	Mathematics – I	4	0	30	70	100	3
EC1102	BS	Physics	4	0	30	70	100	3
EC1103	ES	Digital Logic Design	4	0	30	70	100	3
EC1104	ES	Electronic Devices and Circuits	4	0	30	70	100	3
EC1105	ES	Network Theory and Machines	4	0	30	70	100	3
EC1106	ES	Digital Logic Design Lab	0	3	50	50	100	1.5
EC1107	BS	Physics Lab	0	3	50	50	100	1.5
EC1108	ES	Electronic Devices and Circuits Lab	0	3	50	50	100	1.5
							Total Credits	**19.5**

B.Tech & B.Tech+M.Tech
I Year - II Semester
(with effect from 2022-23 admitted Batch)

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC1201	BS	Mathematics – II	4	0	30	70	100	3
EC1202	BS	Green Chemistry	4	0	30	70	100	3
EC1203	HSS	English	4	0	30	70	100	3
EC1204	ES	Computer Programming and Numerical Methods	4	0	30	70	100	3
EC1205	ES	Electronic Circuit Analysis	4	0	30	70	100	3
EC1206	HSS	English Language Lab	0	3	50	50	100	1.5
EC1207	BS/ES	Electronic Circuit Analysis Lab	0	3	50	50	100	1.5
EC1208	ES	Computer Programming and Numerical Methods Lab	0	3	50	50	100	1.5
							Total Credits	**19.5**

B.Tech & B.Tech+M.Tech

II Year - I Semester

(with effect from 2022-23 admitted Batch)

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC2101	BS	Mathematics -III	4	0	30	70	100	3
EC2102	PC	Python Programming	4	0	30	70	100	3
EC2103	PC	Analog Communications	4	0	30	70	100	3
EC2104	PC	Signals & Systems	4	0	30	70	100	3
EC2105	HSS	Managerial Economics	4	0	30	70	100	3
EC2106	PC	Python Programming Lab	0	3	50	50	100	1.5
EC2107	PC	Analog Communications Lab	0	3	50	50	100	1.5
EC2108	PC	Signals & Systems Simulation Lab	0	3	50	50	100	1.5
EC2109	SC	Digital Circuit Simulation	1	2	50	50	100	2
EC2110	MC	Professional Ethics and Universal Human Values	0	0	00	100	100	0
EC2111	MC	NCC/NSS	0	2	-	-	-	0
							Total Credits	**21.5**

B.Tech & B.Tech+M.Tech

II Year - II Semester

(with effect from 2022-23 admitted Batch)

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC2201	ES	Probability theory and Random Process	4	0	30	70	100	3
EC2202	PC	Electromagnetic Field Theory and Transmission Lines	4	0	30	70	100	3
EC2203	PC	Microprocessors and Microcontrollers	4	0	30	70	100	3
EC2204	PC	Linear ICs & Applications	4	0	30	70	100	3
EC2205	PC	Pulse and Digital Circuits	4	0	30	70	100	3
EC2206	PC	Microprocessors & Microcontrollers Lab	0	3	50	50	100	1.5
EC2207	PC	Linear ICs & Pulse Circuits Lab	0	3	50	50	100	1.5
EC2208	SC	Electronic Circuit Simulation	1	2	50	50	100	2
EC2209	MC	Environmental Science	0	0	00	100	100	0
							Total Credits	**20**
Internship-I (2months Duration)								

B SCHEME and Syllabus
(With effect from 2022-23 admitted Batch)
B.Tech & B.Tech+M.Tech
III Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC3101	PC	Control Systems	4	0	30	70	100	3
EC3102	PC	Digital Communications	4	0	30	70	100	3
EC3103	PC	Internet of Things	4	0	30	70	100	3
EC3104	PE	Professional Elective-I	4	0	30	70	100	3
EC3105	OE	Open Elective-I	4	0	30	70	100	3
EC3106	PC	Digital Communication Lab	0	3	50	50	100	1.5
EC3107	PC	Internet of ThingsLab	0	3	50	50	100	1.5
EC3108	SC	Object Oriented Programming through JAVA	1	2	50	50	100	2
EC3109	INT	Internship-I			50	50	100	2
Internship-I(2months) done after 2nd Year 2nd Semester to be evaluated during 3rd Year 1st Semester								
							Total Credits	**22**

B.Tech & B.Tech+M.Tech
III Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC3201	PC	Antennas and Wave Propagation	4	0	30	70	100	3
EC3202	PC	Digital Signal Processing	4	0	30	70	100	3
EC3203	PC	Microwave Engineering	4	0	30	70	100	3
EC3204	PE	Professional Elective-II	4	0	30	70	100	3
EC3205	OE	Open Elective-II	4	0	30	70	100	3
EC3206	PC	Antenna Simulation Lab	0	3	50	50	100	1.5
EC3207	PC	Digital Signal Processing Lab	0	3	50	50	100	1.5
EC3208	PC	Microwave Engineering Lab	0	3	50	50	100	1.5
EC3209	SC	Soft Skills	1	2	50	50	100	2
							Total Credits	**21.5**
Internship-II (2months Duration)								

B.Tech & B.Tech+M.Tech
IV Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC4101	PE	Professional Elective-III	4	0	30	70	100	3
EC4102	PE	Professional Elective-IV	4	0	30	70	100	3
EC4103	PE	Professional Elective-V	4	0	30	70	100	3
EC4104	OE	Open Elective-III	4	0	30	70	100	3
EC4105	OE	Open Elective-IV	4	0	30	70	100	3
EC4106	HSSE	HSS-Elective	4	0	30	70	100	3
EC4107	SC	WEB Technologies	1	2	50	50	100	2
EC4108	INT	Internship-II			50	50	100	2
Internship-II (2months) done after 3rdYear 2nd Semester to be evaluated during 4th Year 1st Semester								
							Total Credits	**22**

B. Tech & B. Tech+M.Tech
IV Year - II Semester

Course code	Category	Course Title	Internal Marks	External Marks	Total Marks	Credits
EC4201	PROJ	Project work	100	100	200	14
					Total Credits	**14**

<u>Note:</u> It is mandatory to complete one MOOCS Course (12 weeks or more duration) to obtain B.Tech Degree in ECE. This can be added in Lieu of any other courses.

PROFESSIONAL ELECTIVES (PE)

1. Global Positioning System.
2. Radar Engineering.
3. Cellular Mobile Communication.
4. Electronic Measurements and Instrumentation.
5. Data Structures.
6. EMI/EMC.
7. Internet and Web Technology.
8. Speech Processing.
9. Computer Networks.
10. TV and Satellite Communication System.
11. Transducers and Signal Conditioning.
12. VLSI Design.
13. Digital Image Processing.
14. Smart Antenna Systems.
15. Advanced Microprocessors.

OPEN ELECTIVES (OE)

1. Low Power VLSI Design.
2. Wireless Sensor Networks.
3. Bio-Medical Instrumentation.
4. FPGA Design.
5. DSP Processors and Architectures.
6. Fiber Optic Communication.
7. GPS Principles and its Applications
8. Mobile Cellular Communication
9. Embedded System Design
10. Information Theory and Coding
11. Artificial Neural Networks
12. Data Science.
13. Artificial Intelligence and Machine Learning.

HSS ELECTIVES (HSSE)

1. Industrial Management & Entrepreneurship.
2. Organizational Behavior.
3. Operations Research.
4. Financial Management for Engineers.

EC1101- MATHEMATICS-I (BS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1101	Mathematics -I	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

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

CO1: Find the partial derivatives of functions of two or more variables.

CO2: Evaluate maxima and minima, errors and approximations.

CO3: Evaluate double and triple integrals, volumes of solids and area of curved surfaces.

CO4: To expand a periodical function as Fourier series and half-range Fourier series.

CO5: Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Partial Differentiation: Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

UNIT-II: Applications of Partial Differentiation: Geometrical interpretation -Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential, Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign- Leibnitz's rule.

UNIT-III: Multiple Integrals: Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

UNIT-IV: Multiple Integrals-Applications: Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions, Error Function or Probability Integral.

UNIT-V: Fourier series: Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula, Practical Harmonic analysis.

Text Books:

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

Reference Books:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

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EC1102- PHYSICS (BS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1102	Physics	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonic's and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To learn basics of lasers and optical fibers and their use in some applications.
- To understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.

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

CO1: Understand the fundamentals of Thermodynamics and Laws of thermodynamics.

CO2: Understand the concept of the electromagnetic waves, gain knowledge on electromagnetic induction and its applications.

CO3: Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit.

CO4: Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.

CO5: Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one-Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Thermodynamics: Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

UNIT-II: Electromagnetism: Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

UNIT-III: Ultrasonic's: Introduction, Production of Ultrasonic's – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonic.

UNIT-IV: Optics: Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications. Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment). Polarization: Polarization by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

UNIT-V: Lasers and Fiber Optics: Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers. Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fiber, Numerical aperture, Modes of propagations, classification of fibers, Fiber optics in communications, Application of optical fibers.

UNIT-VI: Modern Physics: Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of

energy band formation in solids, Classification of materials into conductors, semiconductors and insulators.

UNIT-VII: Nano-phase Materials: Introduction, properties, Top-down and bottom-up approaches, Synthesis - Ball milling, Chemical vapor deposition method, sol-gel methods, Applications of Nano materials.

Text Books:

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand.
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai.

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva.
2. University Physics by Young and Freedman.

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EC1103- DIGITAL LOGIC DESIGN (ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1103	Digital Logic Design	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To understand Different number systems, digital logic, simplification and minimization of Boolean functions.
- To analyze logic processes and implement logical operations using combinational logic circuits.
- To analyze the characteristics of memory and their classification.
- To design combinational & sequential digital circuits and state machines.
- To understand about programmable logic devices.

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

CO1: Discuss the significance of number systems, conversions, binary codes.

CO2: Apply different simplification methods for minimizing Boolean functions.

CO3: Analyze the design concepts of various combinational circuits.

CO4: Analyze the concepts of sequential logic design.

CO5: Categorize Mealy & Moore models and Design Synchronous Sequential machines.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: Number systems and codes: Number systems, Base conversion methods, Complement of numbers, Codes: Binary, Non-binary, Decimal, Alphanumeric, Gray, and Error detecting and error correcting codes. Logic Gates: AND, OR, NOT, NAND, NOR, XOR, EX-NOR and Universal Gates, Minimization of Boolean Functions: Fundamental postulates of Boolean algebra, Basic theorems, Simplification of Boolean equations, Min terms, Max terms, Standard form of Boolean functions. Simplification of functions: Karnaugh map method and Quine-McClusky methods (up to six variables), Multiple Output functions, and incomplete specified functions.

UNIT-II: Combinational Logic-Circuit Design-1: Logic design of combinational circuits: Adders and Subtractions: Binary, BCD, Excess -3 and Look –ahead-carry adder, Code converters, Multiplexers, De multiplexers, Encoders, Decoders and priority encoders, Realization of Boolean functions using multiplexers, De multiplexers and Decoders.

UNIT-III: Combinational Logic-Circuit Design-I1: Design of 4-bit comparator, Parity checker/Generator, Seven segment decoders, Hazards in combinational circuits, Hazard free realizations. Basics of PLDs: Basic structure of PROM, PAL, PLA, CPLD, FPGAs, Realization of Boolean functions with PLDs and their merits and demerits.

UNIT-IV: Sequential circuits: Classification of sequential circuits, SR-latch, Gated latches, Flip flops: RS, JK, D, T and Master slave flip flops, Excitation tables, flip flop conversion from one type to another. Design of counters: Ripple counters, Synchronous counters, asynchronous counters, up-down counters, Johnson counter, ring counter. Design of registers: Buffer registers, Shift registers, Bi directional shift registers, Universal shift register.

UNIT-V: Analysis and design of finite state machines: State assignment, State tables, Equivalent states, Elimination of Redundant states, Determination of state equivalence, Reduction using implication table, and reducing incompletely specified state tables.

Text Books:

1. Switching and finite Automatic theory, ZuiKohari, TMH.

2. Switching theory and logic design by Frederick.J.Hill and Gerald.R.Peterson.

3. Switching theory and logic design, Ananda kumar, PHI.

Reference Books:

1. Fundamentals of Logic Design, Charles.R.Roth, Thomson Publications.

2. Digital Design by Morries Mono, PHI. ECE:

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EC1104 - ELECTRONIC DEVICES AND CIRCUITS (ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1104	Electronic Devices and Circuits	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To understand the operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To apply concepts for the design of Filters, Regulators, Oscillators and Amplifiers for different applications.
- To analyze the theoretical concepts through laboratory and simulation experiments.
- To apply how to implement mini projects using electronic circuit concepts.

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

CO1: Illustrate fundamentals of semiconductor physics for active devices.

CO2: Demonstrate the characteristics of PN Junction diodes and illustrate the functional behavior of different types of special semiconductor devices.

CO3: Examine the V-I characteristics and different BJT amplifier configurations.

CO4: Analyze BJT biasing and low frequency response of the BJT amplifiers.

CO5: Understand the JFET operation and its small signal operation.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: Energy band theory of solids and transport phenomenon in semiconductors: Energy Band Theory of Solids Intrinsic and Extrinsic Semiconductors Doping, Doping Materials, Carrier Mobility, Conductivity, Diffusion and continuity equation, Hall – Effect. Semiconductor Diodes Band structure of PN Junction, Quantitative Theory of PN Diode, and Volt – Amp, Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction.

UNIT-II: Rectifiers and special diodes: Diode Rectifiers: Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics, Zener and Avalanche Breakdowns, Tunnel Diode, LED, Schottky Barrier Diode, Varactor Diode, Photo Diode, PIN Diode.

UNIT-III: Transistor Characteristics and Transistor Biasing: Bipolar Junction Transistor NPN and PNP junction Transistor, Characteristics of Current Flow across the Base Regions, Minority and Majority Carrier Profiles, CB, CE and CC Configurations and their Input and Output Characteristics, Comparison of CE, CB, and CC Configurations, Junction Biasing for Saturation, Cutoff and Active Region, α and β Parameters and the relation between them, Biasing circuits, thermal runaway, thermal stability, stabilizations circuits.

UNIT-IV: Transistor at Low Frequencies: Small Signal: Low Frequency Transistor Amplifier Circuits Transistor as an Amplifier, h – parameter model, Analysis of Transistor Amplifier Circuits using h –parameters, CB, CE and CC Amplifier configurations and performance factors, Analysis of Single Stage Amplifier, RC Coupled Amplifiers, Effects of Bypass and Coupling Capacitors. Frequency Response of CE Amplifier, Emitter – Follower, Cascaded Amplifier.

UNIT-V: Field Effect Transistors: JFET and its characteristics, Pinch off Voltage, Drain Saturation Current, MOSFET–Enhancement and Depletion Modes, JFET Configurations, JFET biasing, Small signal models of FET, JFET Common Source amplifier.

Text Books:

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millmann and D. Halkias, McGraw Hill.
2. Electronic Devices and Circuits, G.S.N. Raju, I.K. International Publications, New Delhi, 2006.

Reference Books:

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press, 2013.
2. Electronic Devices and Circuits 2nd Edition, B. V. Rao and K. Raja Rajeswari, Pearson Education.

3. Electronic Devices and Circuits, K. Venkat Rao, K. Rama Sudha, McGraw Hill education, Edition-2015.

4. Electronic Devices and Circuits Theory, Boylsted and Nashelsky, Prentice Hall Publications.

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EC1105 - NETWORK THEORY AND MACHINES (ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1105	**Network Theory and Machines**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course objectives:

The objectives of this course are

- Will be able to articulate in working of various components of an electrical circuit.
- Will be familiar with application of theorems to ac and dc circuits.
- Ability to Express given Electrical Circuit parameter and solve the circuits.
- Understand the operating principle of a DC motor and DC generator.
- Will know about construction features of dc and ac machines.
- able to find the performance of a dc and ac machines for a given specifications.

Course Outcome:

Upon completion of the course the student should have the ability to

CO1: Analyze the Fundamentals of D.C circuits and the concept of Node and Mesh analysis.

CO2: Understand, analyze and application of Network theorems.

CO3: Analyze and determine Fundamentals of A.C circuits.

CO4: Analyze the working principles of DC machines.

CO5: Understand working of AC machines and synchronous motors.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Analysis of DC Circuits: Active elements, Passive elements, Reference directions for current and voltage, Kirchoffs Laws, Voltage and Current Division, Nodal Analysis, Mesh analysis, Linearity and superposition, Thevinin's theorem and Norton's theorem, star-delta transformations, Source Transformation, Maximum power transfer theorem, Reciprocity theorem, Z, Y, H, S parameters.

UNIT-II: DC transients: Inductor, Capacitor, source free RL, RC and RLC response, Evaluation of Initial conditions, Application of unit-step function to RL, RC and RLC circuits, concepts of Natural, Forced and Complete response.

UNIT-III: Introduction to AC circuits: The sinusoidal forcing function instantaneous, Phasor concept, Average and Effective value of Voltage and Current, instantaneous and Average Power, Complex Power steady state analysis using mesh and node analysis, application of network theorems to AC circuits, resonance, Concept of Duality.

UNIT-IV: DC Machines: Principle of operation of DC machines, Constructional Details, EMF equation, Types of DC machines, Torque Equation, Characteristics of DC Generators, necessity of starters, speed control methods, DC Motor Characteristics, applications of DC Machines, Swinburne's Test, Brake test on DC shunt motor.

UNIT-V: AC Machines: Transformer Principle of operation and construction Details, EMF equation, Open Circuit & Short Circuit Test, Principle of operation of Three Phase Induction Motors, Constructional Details, Principle of operation of Single Phase Motor, Double Revolving Field Theory, Universal Motor, Stepper Motor, Principle of operation of synchronous machines, Synchronous Condenser and Applications.

Text Books:

1. Electrical Circuits by A.Chakrabarthy- Dhanapat Raj and Sons.
2. Engineering Circuit analysis By William Hayt and JackE,kemmerly-TMH.
3. A Textbook of Electrical Technology : Ac and Dc Machines (volume - 2) by B L Theraja and A K Theraja.
4. A First Course In Electrical Engineering, S. M. Tiwari, A. S. Binsaroor, Wheeler Publications.

Reference Books:

1. Principles Of Electrical Engineering And Electronics by V.k. Mehta and Rohit Mehta, S.Chand.
2. Electrical Machines, S. K. Bhattacharya, TMH Publications N. Delhi.

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EC1106 - DIGITAL LOGIC DESIGN LAB (ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1106	**Digital Logic Design Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

The objectives of this course are

- To Verify Logic gates.
- To Verify Half adders and full adders.
- To Design ripple counter and synchronous counter.
- To Design shift registers and seven segment display.

Course Outcomes: At the end of the course the student will be able to

CO1: Implement logic gates, universal gates and their realization using ICs.

CO2: Able to realize SOP and POS forms and verifying Demorgan's laws.

CO3: Experimentally analyze combinational and sequential circuits using ICs.

CO4: Implement the logic gates, full Adder, Decoder, Encoder, MUX and DeMUX.

CO5: Implement and Analyze Flip-Flops, Shift Register and Counters.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Hardware Experiments:

1. Experimentally verify truth tables of different Logic Gates.

2. Experimental realization of Gates by using universal building blocks.

3. Experimental realization of SOP and POS forms.

4. Experimental Verification of Demorgan's Laws.

5. Design and verify Half Adder & Full adder digital circuits for different bit lengths.

6. Function generation by using Decoders & Multiplexers.

7. Experimental Realization of Flip – flops.

8. Experimental 4-bit Ripple counters.

9. Design and verify Mod-8 Synchronous counter.

10. Design and verify Up down counter.

11. Experimental verification of 4 - bit Shift-register.

12. Design and experimental verification of seven segment display.

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EC1107- PHYSICS LAB (BS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1107	**Physics Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

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

- Ability to design and conduct experiments as well as to analyze and interpret.
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics**.**
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.
- Determine the Thickness for given paper strip by wedge method.

Course Objectives: The objectives of this course are

CO1: To enable the students to acquire skill, technique and utilization of the Instruments.

CO2: To draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.

CO3: To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.

CO4: To familiarize the handling of basic physical apparatus like Venire calipers, screw gauge.

CO5: To understand spectrometers, travelling microscope, laser device, optical fiber, etc.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Experiments:

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.

3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray μ_o and extraordinary μ_e ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

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EC1108 - ELECTRONIC DEVICES AND CIRCUITS LAB (BS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1108	**Electronic Devices and Circuits Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives: The objectives of this course are

- To Study semiconductor diodes; verify their characteristics and applications of diodes as regulators, rectifiers.
- To Measure the V-I characteristics of various devices that are used in the electronic equipment.
- To Verify functionality through V-I characteristics of active devices like BJT, JFET, MOSFETS and their applications.
- To Determine the gain of CE amplifier

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

CO1: Comprehend the depth of semiconductor devices like diodes, transistor, JFET, MOSFETs characteristics.

CO2: Measure voltage, frequency and phase of any waveform using CRO.

CO3: Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.

CO4: Gain hands on experience in handling electronic components and devices.

CO5: Study and verify various amplifier designs with calculation of impedance and band width.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Experiments:

1. Study of CRO and its Applications.
2. Experimental verification of V-I Characteristics of PN Junction Diode and V-I Characteristics of LED.

3. Experimental verification of V-I Characteristics of Zener Diode and Zener Diode regulation characteristics.
4. Experimental verification of V-I characteristics of Photo diode.
5. Experimentally find DC voltage and ripple factor for Half-wave and full-wave rectifiers.
6. Experimentally find DC voltage and ripple factor for Half-wave and full-wave rectifiers with capacitor filter.
7. Experimentally find h-parameters of BJT in CE configuration from input and output characteristics.
8. Experimentally find h-parameters of BJT in CB configuration from input and output characteristics.
9. Experimentally find Voltage gain, input impedance and output impedance of emitter follower configuration.
10. Plot Drain and transfer characteristics of JFET.
11. Plot frequency response of CE amplifier to find input impedance, Bandwidth and gain.
12. Plot frequency response characteristics JFET in CS configuration.

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EC1201 MATHEMATICS – II (BS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1201	**Mathematics – II**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The objectives of this course are

- The way of obtaining rank, Eigen values and Eigen vectors of a matrix.
- To know the importance of Clayey-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

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

CO1: Find rank, Eigen values and Eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.

CO2: Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.

CO3: Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling.

CO4: Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.

CO5: Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Linear Algebra: Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

UNIT-II: Eigen Values and Eigen Vectors: Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

UNIT-III: Ordinary Differential Equations of First Order and its Applications: Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

UNIT-IV: Differential Equations of Higher Order: Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

UNIT-V: Laplace Transforms: Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t – Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

Text Books:

1. Scope and Treatment as in “Higher Engineering Mathematics”, by Dr. B.S. Grewal, 43r^{d} edition, Khanna publishers.

Reference Books:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

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EC1202 - GREEN CHEMISTRY (BS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1202	Green Chemistry	4			30	70	100	3hrs	3

COURSE OBJECTIVES:

- To apply the basic knowledge of Chemistry to the Engineering Discipline. To develop knowledge about water and its treatment for industrial and potable PURPOSES.
- To develop understanding in the areas of Batteries, Fuels Mechanism of Corrosion of Metals and Corrosion Control Methods, Green Chemistry and Technology and Processes involving Green Chemistry and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcomes: The students are able to

CO1: To know the treatment methods of water and different softening methods.

CO2: To understand the construction of different types of batteries.

CO3: To understand different types of fuel cells.

CO4: To differentiate types of corrosion and its irradiation.

CO5: To understand the concepts of green chemistry and its importance.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Water Technology

Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

UNIT-II: Batteries

Primary batteries: The chemistry - Types: Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells – liquid cathode, solid cathode and lithium-ferrous

sulphide cells. Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells. Advanced Batteries for electric vehicles, requirements of the battery – sodium-beta and redox batteries.

UNIT-III: Fuel Cells

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells- Membranes and Fuels

UNIT-IV: Corrosion

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion, Corrosion Controlling Methods, Protective Coatings, Metallic Coatings, Electroplating and Electroless Plating.

UNIT-V: Green Chemistry and Technology

Introduction and significance of green chemistry, Goals of green chemistry, 12 principles of green chemistry, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, functional group approaches to green chemistry, Elimination of toxic functional group, optimization of frameworks for the design of greener synthetic pathways, Applications of green chemistry - Green solvents, green fuels and propellants, biocatalysis.

Text Books

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.
3. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

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EC1203- ENGLISH (HSS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1203	English	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To make students understand the explicit and implicit meanings of a text/topic.
- To give exposure to new words and phrases, and aid to use them in different contexts.
- To apply relevant writing formats to draft essays, letters, emails and presentations.
- To adapt oneself to a given situation and develop a functional approach to finding solutions-adaptability and problem solving.

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

CO1: Analyze a given text and discover the various aspects related to language and literature.

CO2: Learn the various language structures, parts of speech and figures of speech.

CO3: Learn time management, ethics and its values.

CO4: Develop one's reading and writing abilities for enhanced communication.

CO5: To apply the topics in real-life situations for creative and critical use.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

UNIT-II: The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

UNIT-III: The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama.

UNIT-IV: Life skills: Innovation

Muhammad Yunus.

Politics and the English Language: George Orwell.

UNIT-V: Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave.

UNIT-VI: Grammar:

Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

UNIT-VII: Vocabulary:

Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations.

UNIT-VIII: Writing:

Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary.

Writing: Essay Writing.

UNIT-IX: Life skills: Innovation

Muhammad Yunus.

Text Books: Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

Reference Books:

1. Practical English Usage, Michael Swan. OUP. 1995.
2. Remedial English Grammar, F.T. Wood. Macmillan.2007.
3. On Writing Well, William Zinsser. Harper Resource Book. 2001.
4. Study Writing, Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

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EC1204 - COMPUTER PROGRAMMING AND NUMERICAL METHODS (ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1204	**Computer Programming and Numerical Methods**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The objectives of this course are

- To provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics this will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

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

CO1: Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and apply them in problem solving.

CO2: Apply various operations on derived data types like arrays and strings in problem solving.

CO3: Design and implement of modular Programming and memory management using Functions, pointers.

CO4: Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.

CO5: Apply Numerical methods to solve the complex Engineering problems.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

UNIT-II: Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if…else statement, Nesting of if…else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops, One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

UNIT-III: Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values, Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

UNIT-IV: Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointes, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications.

UNIT-V: Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

UNIT-VI: File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments-Program Applications

UNIT-VII: Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Books:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall.

Reference Books:

1. Let Us C, YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

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EC1205 - ELECTRONIC CIRCUIT ANALYSIS (ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1205	**Electronic Circuit Analysis**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The objectives of this course are

- To prepare students to perform the analysis of any Analog electronics circuit.
- To empower students to understand the design and working of BJT /FET.
- To empower students to understand the design and working of amplifiers and oscillators.
- To empower students to understand the design and working of Operational Amplifier.
- To prepare the students for advanced courses in Communication system Circuit Design.

Course Outcomes: At the end of the course the student will be able to

CO1: Acquire knowledge of small signal and high frequency analysis of BJT.

CO2: Ability to design and analyze multistage amplifiers.

CO3: Understand the concepts of positive feedback and negative feedback on different amplifier configurations.

CO4: Develop the ability to design different types of oscillator circuits

CO5: Acquire knowledge about tuned amplifiers and its importance in different communication applications.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Small Signal High Frequency Transistor Amplifier models: BJT: Transistor at high frequencies, Hybrid- common emitter transistor model, Hybrid- conductance's, Hybrid- capacitances, validity of Hybrid- model, determination of high frequency parameters in terms of low frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product. FET: Analysis of common source and common drain amplifier circuits at high

frequencies.

UNIT-II: Multistage Amplifiers: BJT and FET RC Coupled Amplifiers – Frequency Response, Cascaded Amplifiers, Calculation of Band Width of Single and Multistage Amplifiers, Concept of Gain Bandwidth Product.

UNIT-III: Feedback Amplifiers: Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics, Different Feedback Amplifier Topologies, Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

UNIT-IV: Sinusoidal Oscillators: Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators, Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators -- RC Phase Shift and Wein bridge Oscillators (BJT and JFET models)

UNIT-V: Tuned Voltage Amplifiers and Power Amplifiers: Single Tuned and Stagger Tuned Amplifiers – Analysis, Double Tuned Amplifier, Bandwidth Calculation, Classification of Power Amplifiers–Class A, Class B and Class AB power Amplifiers, Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – HeatSinks.

Text Books:

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill, 1972.
2. Electronic Devices, G.S.N. Raju, IK International Publications, New Delhi, 2006.
3. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press, 2013.

Reference Books:

1. Electronic Circuit Analysis, B. V. Rao, K. Raja Rajeswari et.al, Pearson Publishers.
2. Electronic Devices and Circuits by Salivahanan, N. Suresh Kumar and A. Vallava Raj TMH, 2nd Edition, 1998.
3. Electronic Devices and Circuits – G. K. Mithal, Khanna Publishers, 23rd Edition,2004.

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EC1206 - ENGLISH LANGUAGE LAB (HSS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1206	**English Language Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives: The objectives of this course are

- To make students recognize the sounds of English through Audio-Visual aids.
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English.
- To familiarize the students with stress and intonation and enable them to speak English effectively.
- To give learners exposure to and practice in speaking in both formal and informal contexts.

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

CO1: Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced.

CO2: A student is able to inculcate the habit of good reading and writing skills.

CO3: A study of the communicative items in the laboratory will help students become successful in the competitive world.

CO4: Students will be able to participate in group activities like roleplays, group discussions and debates.

CO5: Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

UNIT-II: Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

UNIT-III: Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

UNIT-IV: Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

UNIT-V: Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. Effective Technical Communication. Tata McGraw Hill Education Private Limited, New Delhi.
2. Speak Well. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. Body Language. Manjul Publishing House, New Delhi.

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EC1207- ELECTRONIC CIRCUIT ANALYSIS LAB (BS/ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1207	**Electronic Circuit Analysis Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives: The objectives of this course are

- To Design feedback amplifiers.
- To generate a sinusoidal signal using oscillators.
- To simulate oscillators and power amplifiers.
- To determine the frequency response of op-amp.

Course Outcomes: At the end of the course the student will be able to

CO1: Determine the frequency response of BJT and JFET multistage amplifiers.

CO2: Design different types of feedback amplifiers and understands its applications.

CO3: Design LC oscillators to generate sinusoidal signal of desired frequency.

CO4: Design RC oscillators to generate sinusoidal signal of desired frequency.

CO5: Design the power amplifier and able to differentiate between different power amplifier configurations.

SYLLABUS

(with effect from 2022-23 admitted Batch)

List of Experiments:

1. Design two stage RC-Coupled Amplifier to find frequency response characteristics.
2. Design JFET common source amplifier to find its input impedance and frequency response characteristics.
3. Design Voltage series feedback Amplifier.
4. Design Current series feedback Amplifier
5. Design Voltage shunt feedback amplifier.
6. Design RC-Phase shift oscillator.
7. Design Wein bridge oscillator.

8. Design Hartley Oscillator.
9. Design Colpitts oscillator.
10. Design Class-A power amplifier.
11. Design Class-B Push-pull Amplifier.

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EC1208 - COMPUTER PROGRAMMING AND NUMERICAL METHODS LAB (ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 1208	**Computer Programming and Numerical Methods Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives: The objectives of this course are

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.
- To write and execute programs in C to solve problems such as arrays, files, strings structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

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

CO1: Understand various computer components, Installation of software, C programming development environment, compiling, debugging, and linking and executing a program using the development environment.

CO2: Analyzing the complexity of problems, modularize the problems into small modules and then convert them into programs.

CO3: Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.

CO4: Apply and practice logical ability to solve the real world problems.

CO5: Apply Numerical methods to solve the complex Engineering problems.

SYLLABUS
(with effect from 2022-23 admitted Batch)

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, copying one string to another, reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/
12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

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EC2101 Mathematics – III (BS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2101	**Mathematics – III**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The student should be able to learn the concepts:

- About the differential operators like gradient, divergence and curl.
- Evaluation of Line integrals, Surface integrals, Volume integrals and their transformations using Green's theorem, Stoke's theorem, Gauss Divergence theorems along with their applications in Engineering.
- Differentiation and integration of complex functions and evaluation of complex integration using Cauchy's theorem and Cauchy's integral formula.
- Conformal mappings, expansion of complex functions as Taylor's and Laurent's series. Evaluation of integrals using Cauchy's Residue Theorem.
- Formulate the Partial Differential Equations. Solving first order linear and non-linear Partial Differential Equations, Homogeneous and Non-homogeneous linear partial differential equations with constant coefficients. The concept of Fourier Transforms, Fourier Sine, Cosine and their applications to Engineering problems.

Course outcomes: On completion of this course, students are able to

CO1: Interpret the meaning and evaluation of different differential operators such as gradient, curl and divergence.

CO2: Apply Line integrals, Surface integrals, Volume integrals and their relations using Green's theorem, Stoke's theorem, Gauss Divergence theorems in various engineering applications.

CO3: Apply Cauchy-Riemann equations to complex functions to verify analyticity, evaluation of integration along the given path using Cauchy's theorem and Cauchy's integral formula.

CO4: Represent a given complex function in Taylor's & Laurent's series in the given region. Make use of the Cauchy residue theorem to evaluate certain integrals.

CO5: Formation, solution of first order linear, non-linear Partial Differential Equations, solution of higher order linear Partial Differential Equations The use of the knowledge of Fourier transforms, Fourier Sine, Cosine as a mathematical tool to evaluated certain wave forms.

SYLLABUS

(with effect from 2022-23 admitted Batch)

Unit-I: Vector Calculus-Differentiation- Differentiation of vectors, curves in space, velocity and acceleration, scalar and vector point functions, vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e., ∇f, $\nabla.\overline{F}$, $\nabla\times\overline{F}$), Irrotational and Solenoidal fields, the relations obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

Unit-II: Vector Integration- Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs)

Unit-III: Functions of Complex Variables- Introduction-Limit and continuity of f(z)- Derivative of f(z), Cauchy-Reimann Equations, Analytic Functions, Harmonic functions, Applications to flow problems. Integration of complex functions, Cauchy's theorem, Cauchy's integral formula and their applications.

Unit-IV: Conformal Mappings and Contour Integration - Introduction to Conformal transformation, Bilinear transformation $w=\frac{az+b}{cz+d}$, Series of complex terms -Taylor's and Laurent's series (without proofs), Zero's and Singularities. Residues and Calculations of residues, Cauchy's Residue Theorem (without proofs).

Unit-V: Partial Differential Equations &Fourier Transform- Introduction and formation of partial differential equations, solutions of partial differential equations, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order. Homogeneous linear equations with constant coefficients- complementary function, particular integral, non-homogeneous linear equations. Fourier series& transforms - Introduction, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, properties of Fourier transforms. Convolution theorem, Parseval's identity for Fourier transforms.

TEXT BOOKS:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr. B. S. Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics by Erwin Kreyszig.
2. A Text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal,Lakshmi Publications.
3. Advanced Engineering Mathematics by H. K. Dass. S. Chand Company.
4. Complex variables and applications, James Ward Brown, Ruel V. Churchill, McGraw Hill.

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EC2102 - PYTHON PROGRAMMING (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2102	**Python Programming**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

1. To develop skills on procedural oriented and object-oriented programming in Python.
2. To understand and apply different data wrangling techniques using Python.
3. To perform data analysis using python libraries like NumPy, Pandas and exploratory data analysis using Matplotlib.

Course Outcomes:

At the end of the course, a student should be able to:

CO1: Acquire programming knowledge on Basics of Python.
CO2: Acquire programming knowledge on Text and File Handling.
CO3: Develop Python programs to Mean, Median, Mode, Correlation.
CO4: Acquire programming knowledge on NumPy, Pandas Library.
CO5: Acquire programming knowledge on Graph Visualizations in Python and Data Analysis using Python.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Introduction to Python: Rapid Introduction to Procedural Programming, Data Types: Identifiers and Keywords, Integral Types, Floating Point Types. Strings: Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods, String formatting with str.format. Collections Data Types: Tuples, Lists, Sets, dictionaries, Iterating and copying collections.

UNIT-II: Python Control Structures, Functions and OOP: Control Structures and Functions: Conditional Branching, Looping, Exception Handling, Custom Functions. Python Library Modules: random, math, time, os, shutil, sys, glob, re, statistics, creating a custom module. Object Oriented Programming: Object Oriented Concepts and Terminology, Custom Classes, Attributes and Methods, Inheritance and Polymorphism, Using Properties to Control Attribute Access. File Handling: Writing and Reading Binary Data, Writing and Parsing Text Files.

UNIT-III: NumPy Arrays and Vectorized Computation: NumPy arrays, Array creation, Indexing and slicing, Fancy indexing, Numerical operations on arrays, Array functions, Data processing using arrays, Loading and saving data, saving an array, Loading an array, Linear algebra with NumPy, NumPy random numbers.

UNIT-IV: Data Analysis with Pandas: An overview of the Pandas package, The Pandas data structure-Series, The Data Frame, The Essential Basic Functionality: Reindexing and altering labels, Head and tail, Binary operations, Functional statistics, Function application Sorting, Indexing and selecting data, Computational tools, Working with Missing Data, Advanced Uses of Pandas for Data Analysis - Hierarchical indexing, The Panel data.

UNIT-V: Data Analysis Application Examples: Data munging, cleaning data, Filtering, merging data, Reshaping data, Data aggregation, Grouping data.

UNIT-VI: Data Visualization: The matplotlib API primer-Line properties, Figures and subplots, Exploring plot types-Scatter plots, Bar plots, Histogram plots, Legends and annotations, Plotting functions with Pandas.

Text Books:

1. Programming in Python 3: A Complete Introduction to Python Language, Mark Summerfield, Second Edition, Addison-Wesley Publications.
2. Python: End-to-End Data Analysis Learning Path, Module 1: Getting Started with Python Data Analysis, Phuong VothiHong , Martin Czygan, , Packt Publishing Ltd.

Reference Books:

1. Learning Python, 5th Edition, Mark Lutz, Orielly Publications.
2. Python for Data Analysis, Wes McKinney, Orielly Publications.

3. How to Think Like a Computer Scientist: Learning with Python 3 Documentation 3rd Edition, Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers.
4. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall.
5. Python Cookbook – Recipes for Mastering Python 3,3rd Edition, David Beazley, Brian K. Jones, Oreilly.

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EC2103 - ANALOG COMMUNICATIONS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2103	**Analog Communications**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The objectives of this course are

- To familiarize with the fundamentals of analog communication systems.
- To learn various techniques for analog modulation and demodulation of signals.
- To develop the ability to classify and understand various functional blocks of radio transmitters and receivers.
- To know basic techniques for generating and demodulating various pulse modulated signals.

Course Outcomes: At the end of the course the student will be able to

CO1: Understand the basic concepts of analog communication system and compare various amplitude modulation techniques with spectral characteristics.

CO2: Differentiate the angle modulation schemes with linear modulation techniques.

CO3: Categorize the noise behavior on analog communication systems.

CO4: Analyze different Radio transmitters and receivers to understand their performance.

CO5: Understand and Compare the various analog pulse modulation systems.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Linear Modulation Systems: Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Modulators and Demodulators (Diode detector), DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, Application of AM Systems.

UNIT-II: Angle Modulation Systems: Angle Modulation, Phase and Frequency Modulation and

their Relationship, Phase and Frequency Deviation, Spectrum of an FM Signal, Bandwidth of Sinusoidally Modulated FM Signal, Effect of the Modulation Index on Bandwidth, Spectrum of Constant Bandwidth FM, Phasor Diagram for FM Signals, FM Generation: Parameter variation method, Indirect method of Frequency Modulation (Armstrong Method), Frequency Multiplication, PLL FM Demodulator, Pre – emphasis and De – emphasis, Comparison of FM and AM.

UNIT-III: Noise in AM and FM Systems: Sources of Noise, Resistor Noise, Shot Noise, Calculation of Noise in a Linear System, Frequency Domain representation of Noise, The effect of Filtering on the Probability density of Gaussian Noise, Effect of filter on the power spectral Density of Noise, Narrow Bandwidth, Quadrature components of Noise, Power spectral density of Noise, Probability Density of Noise and their time derivatives, representation of Noise using Orthonormal coordinates, Noise in AM Systems, Noise in Angle Modulation Systems, Comparison between AM and FM with respect to Noise, Threshold Improvement in Discriminators, Comparisons between AM and FM.

UNIT-IV: Radio transmitters and receivers: Radio Transmitters - Classification of Radio Transmitters, Principle of a Radio Transmitters, AM and FM Transmitters, Radio Telegraph and Radio Telephone Transmitters, SSB Transmitters. **Radio Receivers:** Radio receiver Types, AM Receivers – RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers – Amplitude Limiting, FM Demodulators, Ratio Detectors, ISB Receiver, Comparison with AM Receivers, Extensions of the Super-heterodyne Principles, Additional Circuits.

UNIT-V: Pulse Analog Modulation methods: Pulse Modulation techniques, Sampling, Types of Sampling and its analysis, Time division Multiplexing, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse position modulation, Pulse Code Modulation.

Text Books:

1. Principles of Communication Systems, H. Taub, D. L. Schilling and Glutamate, TMH 3rd edition, 2007.
2. Principle of Communication Systems, Simon Haykins (2nd Edition).
3. Electronic Communication Systems, G. Kennedy, McGraw Hill, 1977 (2nd Edition).

References:

1. Modern Digital and Analog Communication Systems, B. P. Lathi (2nd Edition).
2. Communication systems, R.P. Singh and S.D. Sapre 2nd edition TMH 2008
3. Electronic Communications Modulation and Transmission, Robert J. Schoenbeck, PHI N. Delhi, 1999.

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EC2104 - SIGNALS AND SYSTEMS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2104	Signals and Systems	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series.
- Fourier transforms and Laplace transforms.
- To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform.
- To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advanced courses.

Course Outcomes: At the end of the course the student will be able to

CO1: Understand the process of sampling and the effects of under sampling, Analyze the discrete time signals and system using different transform domain techniques.

CO2: Design and implement LTI filters for filtering different real-world signals.

CO3: Analyze the frequency domain representation of signals using CTFT and DTFT.

CO4: Interpret signals and analyze system response using convolution integral and compute the correlation of signals.

CO5: Apply the Laplace transform and Z- transform for analyzing continuous-time and discrete-Time signals and systems.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: Introduction to signals and linear time Invariant systems: Basic signals, elementary signals in continues and discrete domain, classification of signals, useful signal operations, discrete signal models, discrete signal operations, classification of systems, basic system properties, Casual LTI Systems Described by Differential and Difference Equations, unit impulse response of a

system, system response to external input, classical solutions of difference equations, system stability.

UNIT-II: Frequency analysis of continuous and discrete signals: Frequency analysis of continuous time signal - Fourier Series Representation of continuous time Periodic Signals, convergence of the Fourier Series, exponential Fourier series, Properties of continuous time Fourier Series, power density spectrum of periodic signals, representation of aperiodic signals, Fourier Transform, transform of some useful functions, Fourier Transform for periodic signals, theorems and properties of Fourier transforms, signal energy. Frequency analysis of Discrete time signal -. Discrete time Fourier series (DTFS), properties of DTFS, power density spectrum of discrete periodic signals, representation of aperiodic signals, discrete time Fourier transform (DTFT), convergence of DTFT, DTFT theorems and properties, energy density spectrum of discrete aperiodic signals.

UNIT-III: Convolution and correlation of signals: System analysis by Convolution, Convolution as a superposition of impulse response, some Convolution relationships, Graphical interpretation of Convolution, Convolution of a function with a unit impulse, Signal comparison, Correlation and Convolution, Some properties of correlation functions, Correlation functions for nonfinite energy signals, Detection of periodic signals in the presence of Noise by correlation, Determination of the waveform of a periodic signal masked by Noise, Extraction of a signal from Noise by filtering.

UNIT-IV: Laplace Transform: Introduction, The Laplace Transform, the region of convergence for Laplace Transforms, The Inverse Laplace Transform, Geometrical evaluation of the Fourier transform from the Pole-Zero plot, Properties of Laplace Transforms, the initial and Final value theorems, Analysis and characterization of LTI systems using the Laplace Transforms.

UNIT-V: Sampling Theorem and Z-transform: sampling theorem, reconstruction of a signal from its samples using interpolation, The effect of Under sampling, aliasing, Discrete time processing of continuous time signals, sampling of Discrete time signals. unilateral Z-Transforms and bilateral Z-Transforms, Properties of Z-Transform, relationship of the Fourier transform to the Z- transform, Inverse Z-Transform by contour integral, power series, partial fraction expansion. decomposing of rational Z-transform, causality and stability, the initial value theorem and final value theorem, some common Z-transform pairs, Analysis and characterization of LTI systems using the Z-Transforms.

Text Books:

1.Signals and Systems, Alan V. Oppenheim, Alan S. Will sky and Ian T. Young, PHI, 2ndEdn.

2.Signal Processing and Linear Systems, B. P. Lathi, Berkeley Cambridge Press.

3. Signals and Systems, K. Raja Rajeswari and B. V. Rao, Prentice Hall of India.

Reference Books:

1. Signals and Systems- Simon Haykin and Van Veen, Wiley 2ndEdn.

2. Signals and Systems – P. Ramesh Babu and R. Ananda Natarajan 3rdEdn.

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EC2105 - MANAGERIAL ECONOMICS (HSS)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2105	**Managerial Economics**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The objectives of this course are

- To integrate the concept of price and output decisions of firms under various market structure.
- To impart the knowledge of economics as a subject and its importance while business.
- The business decisions are made scientifically on the basis of all available information.
- To familiarize the students with the basic concept of microeconomics.
- To understand the demand and supply analysis in business applications
- To familiarize with the production and cost structure under different stages of production.

Course Outcomes: At the end of the course the student will be able to

CO1: To understand the concepts of cost, nature of production and its relationship to Business operations.

CO2: To apply marginal analysis to the "firm" under different market conditions.

CO3: Understands the concept of utility analysis and its limitations.

CO4: To analyze the causes and consequences of different market conditions.

CO5: To integrate the concept of price and output decisions of firms under various market structure.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Significance of Economics and Managerial Economics: Economics: Definitions of Economics- Wealth, Welfare and Scarcity definition Classification of Economics- Micro and Macro Economics. Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

UNIT-II: Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand -Assumptions and limitations. Exceptional demand

curve. Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.
Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, the law of Diminishing Marginal Utility and its Limitations**.**

UNIT-III : Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making; **Cost analysis -** Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale.

UNIT-IV: Market Structures: Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve; Monopolistic Competition.

UNIT-V: Pricing and Business cycles: Pricing analysis: Pricing - Significance: Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing, Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.
Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., **Managerial Economics,** Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., **Managerial Economics and Financial Analysis,** MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., **Managerial Economics,** Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.

3. Dewett, K.K., **Modern Economic Theory**, S. Chand & Company Ltd., New Delhi, 2005.

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EC2106 - PYTHON PROGRAMMING LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2106	**Python Programming Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- familiarize students with key data structures in Python including lists and dictionaries and apply them in context of searching, sorting, text and file handling.
- introduce students to calculation of statistical measures using Python such as measures of central tendency, correlation.
- familiarize students with important Python data related libraries such as Numpy and Pandas and use them to manipulate arrays and data frames.
- introduce students to data visualization in Python through creation of line plots, histograms, scatter plots, box plots and others.
- implementation of basic machine learning tasks in Python including pre-processing data, dimensionality reduction of data using PCA, clustering, classification and cross-validation.

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

CO1: Implement searching, sorting and handle text and files using Python data structures such as lists and dictionaries.

CO2: Calculate statistical measures using Python such as measures of central tendency, correlation.

CO3: Use Python data related libraries such as Numpy and Pandas and create data visualizations.

CO4: Implement basic machine learning tasks pre-processing data, compressing.

CO5: Implement data, clustering, classification and cross-validation.

SYLLABUS
(with effect from 2022-23 admitted Batch)

1. Python Programs on lists & Dictionaries.
2. Python Programs on Searching and sorting.
3. Python Programs on Text Handling.
4. Python Programs on File Handling.
5. Python Programs for calculating Mean, Mode, Median, Variance, Standard Deviation.
6. Python Programs for Karl Pearson Coefficient of Correlation, Rank Correlation.
7. Python Programs on NumPy Arrays, Linear algebra with NumPy.
8. Python Programs for creation and manipulation of DataFrames using Pandas Library.
9. Write a Python program for the following**.**
    - Simple Line Plots,
    - Adjusting the Plot: Line Colors and Styles, Axes Limits, Labeling Plots,
    - Simple Scatter Plots,
    - Histograms,
    - Customizing Plot Legends,
    - Choosing Elements for the Legend,
    - Boxplot
    - Multiple Legends,
    - Customizing Colorbars,
    - Multiple Subplots,
    - Text and Annotation,
    - Customizing Ticks
10. Python Programs for Data preprocessing: Handling missing values, handling categorical data, bringing features to same scale, selecting meaningful features.
11. Python Program for Compressing data via dimensionality reduction: PCA.
12. Python Programs for Data Clustering.
13. Python Programs for Classification.
14. Python Programs for Model Evaluation: K-fold cross validation.

Reference Books

1. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall.
2. Chris Albon, "Machine Learning with Python Cookbook-practical solutions from preprocessing to Deep learning", O'REILLY Publisher,2018.
3. Mark Summerfield, Programming in Python 3--A Complete Introduction to the Python Language, Second Edition, Additson Wesley.
4. Phuong Vo.T.H , Martin Czygan, Getting Started with Python Data Analysis, Packt Publishing Ltd.
5. Armando Fandango, Python Data Analysis, Packt Publishing Ltd.
6. Magnus Vilhelm Persson and Luiz Felipe Martins, Mastering Python Data Analysis, Packt Publishing Ltd.
7. Sebastian Raschka& Vahid Mirjalili, "Python Machine Learning", Packt Publisher, 2017.

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EC2107- ANALOG COMMUNICATIONS LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2107	**Analog Communications Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives: The objectives of this course are

- To understand all types of analog modulation / demodulation principles such as AM, SSB-SC, FM.
- To recognize the importance of pre-emphasis and de-emphasis.
- To design the filters using passive components.
- To Substantiate pulse modulation techniques.

Course Outcomes: At the end of the course the student will be able to

CO1: Generate, detect and analyze different amplitude modulation & demodulation techniques.

CO2: Analyze and design various analog filters using passive components.

CO3: Detect and Analyze frequency modulation & demodulation techniques.

CO4: Construct pre-emphasis and de-emphasis at the transmitter and receiver respectively.

CO5: Able to Analyze T – Type attenuator and Mixer characteristics.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Experiments:

1. AM Modulation and Demodulation
2. Low Pass Filter using passive components
3. High Pass Filter using passive components
4. Active Notch Filter
5. Frequency Modulation and Demodulation
6. Pre-emphasis and De-emphasis
7. T – Type attenuator

8. Band pass filter using passive components
9. Mixer characteristics
10. SSB-SC modulation and demodulation.

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EC2108 - SIGNALS AND SYSTEMS SIMULATION LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2108	**Signals and Systems Simulation Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- To provide background and fundamentals of simulation softwares for the analysis and processing of signals and to generate various continuous and discrete time signals.
- To understand discrete signal design and analysis.
- To provide an overview of signal transmission through linear systems, convolution and correlation of signals and sampling.
- To understand signal representation in digital domain.
- To understand the concept and importance of Fourier and Z-Transforms

Course Outcomes: Upon completion of this course, students will able to:

CO1: Familiarize with signal processing basics.

CO2: Generation of various Signals and Sequences including the operations on signals and sequences.

CO3: Understand Linearity and Time Invariance Properties of a given Systems.

CO4: Find the Fourier Transform of a given signal and plotting its magnitude and phase spectrum and also plot Pole-Zero Maps in Z-Plane.

CO5: Verification of Sampling Theorem**.**

SYLLABUS

(with effect from 2022-23 admitted Batch)

LIST OF EXPERIMENTS

(Simulate the following experiments using signal processing simulation software)

1. Basic Operations on Matrices.
2. Write a program for Generation of Various Signals and Sequences (Periodic

and Aperiodic), such as Unit impulse, unit step, square, sawtooth, triangular, sinusoidal, ramp and sinc functions.

3. Write a program to perform operations like addition, multiplication, scaling, shifting, and folding on signals and sequences and computation of energy and average power.
4. Write a program for finding the even and odd parts of the signal/sequence and real and imaginary parts of the signal.
5. Write a program to perform convolution between signals and sequences.
6. Write a program to perform autocorrelation and cross correlation between signals and sequences.
7. Write a program for verification of linearity and time invariance properties of a given continuous/discrete system.
8. Write a program for computation of unit samples, unit step and sinusoidal response of the given LTI system and verifying its physical reliability and stability properties.
9. Write a program to find trigonometric and exponential Fourier series coefficients of a rectangular periodic signal.
10. Write a program to find the Fourier transform of a given signal and plotting its magnitude and Phase spectrum.
11. Write a program for Sampling theorem and its verification.
12. Write a program for locating the zeros and poles and plotting the pole-zero maps in Z-plane for the given transfer function.

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EC2109 - DIGITAL CIRCUIT SIMULATION (SC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2109	**Digital Circuit Simulation**	**1**		**2**	**50**	**50**	**100**	**3hrs**	**2**

Course Objectives: The objectives of this course are:

- To Verify Logic gates.
- To Verify Half adders and full adders.
- To Design ripple counter and synchronous counter.
- To simulate logic gates and flip flops, combinational and sequential circuits.

Course Outcomes: At the end of the course the student will be able to

CO1: Familiarize with VHDL and VERILOG programming.

CO2: Implement logic gates through VHDL and VERILOG programming.

CO3: Implement full Adder, Decoder, Encoder in VHDL and VERILOG programming.

CO4: Implement MUX and DeMUX in VHDL and VERILOG programming.

CO5: Simulate and Analyze Flip-Flops, Shift Register and Counters using VHDL and VERILOG programming.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Experiments:

SIMULATION OF EXPERIMENTS THROUGH VHDL AND VERILOG PROGRAMMING

1. Simulation of Logic gates.
2. Simulation of Half adder and Full adder.
3. Simulation of Multiplexer.
4. Simulation of De-Multiplexer.
5. Simulation of Decoder.

6. Simulation of Encoder.

7. Simulation of Flip flops (SR, JK, T & D).

8. Simulation of Up-down counters & Shift register.

9. Design and simulation of MOD-9 counter and MOD-n counter.

Reference Books for VHDL & Verilog:

1. M. Morris mano & michae lD. ciletti Digital Design: With An Introduction To The Verilog HDL, VHDL And System Verilog.
2. Peter J. Ashenden: "Digital Design-An Embedded Systems Approach Using VHDL".
3. VHD: Programming by Example, Douglas L. Perry, Fourth Edition.
4. JohnF.Wakerly"DigitalDesignPrinciples&Practices4th Edition.
5. System Verilog for Verification–Chris Spear.
6. Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition by Samir Palnitkar.

Online Resources:

1.https://www.xilinx.com/products/design-tools/ise-design-suite.html

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EC2110 - PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES (MC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2110	**Professional Ethics and Universal Human Values**					**100**	**100**	**3hrs**	**0**

Course Objectives:

- To recognize the moral values that should guide the Engineering profession.
- To resolve moral issues concerning one's profession.
- To develop and exhibit a set of moral beliefs and attitudes that engineers should inculcate.
- To inculcate social values and morality in one's life.
- To develop awareness about Professional/Engineering Ethics and Human Values.

Course Outcomes:

Students will be able to:

CO1: Apply the conceptual understanding of ethics and values into everyday practice.

CO2: Understand the importance of moral awareness and reasoning in life.

CO3: Acquire professional and moral etiquette that an engineer requires.

CO4: Develop the acumen for self-awareness and self-development.

CO5: Develop cultural tolerance and integrity and Tackle real-life challenges with empathy.

SYLLABUS
(with effect from 2022-23 admitted Batch)

Unit - I: HUMAN VALUES: Values - Respect - Caring - Sharing - Honesty- Courage – Self-confidence - Communal Harmony Morals – Virtues.

Unit –II: PROFESSIONAL VALUES: Integrity - Discipline - Valuing time - Cooperation - Commitment - Code of conduct - Challenges in the workplace.

Unit – III: PROFESSIONAL ETHICS: Overview - Engineering ethics - Moral issues - Profession - Models of professional roles – Responsibility.

Unit – IV: RESPONSIBILITIES AND RIGHTS: Safety and risk - Collegiality and loyalty - Confidentiality - Occupational crime - Human rights - Employee rights - Intellectual property rights.

Unit – V: GLOBAL ISSUES: Globalization - Environmental ethics - Computer ethics - Code of ethics - Multinational corporations - Engineers as advisors in Planning and Policy making.

Textbook:

1.R.S. Nagarazan. A Textbook on Professional Ethics and Human Values. New Age International Publishers. 2006.

Reference Books:

1. Premvir Kapoor. Professional Ethics and Human Values. Khanna Publishing House. 2019.
2. B.S. Raghavan. Human Values and Professional Ethics. S.Chand Publications. 2012.
3. R.R. Gaur & Others. A Foundation Course in Human Values and Proff. Ethics. Excel Books. 2009.
4. A. N. Tripathi. Human Values. New Age International (P) Limited. 2009
5. R. Subramanian. Professional Ethics. OUP India. 2013.

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EC2111- NCC/NSS (MC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2111	NCC/NSS			2					0

Course objectives:

- To develop discipline, character, brotherhood, the spirit of adventure and ideals of selfless service amongst young citizens.
- To develop youth leadership in the students.
- To induce social consciousness among students through various camp activities.
- To develop skills and physical fitness among students through indoor and outdoor sports, field and track events.

Course Outcomes: At the end of the course the student will be able to

CO1: Understand the importance of nation building and individual contribution to the same.

CO2: Integrate physical fitness and mental wellbeing.

CO3: Discover grassroots challenges of community.

CO4: creating societal impact and maintain discipline and team spirit.

CO5: uphold the value of one for all and all for one.

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EC2201 - PROBABILITY THEORY AND RANDOM PROCESS (ES)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2201	**Probability Theory and Random Process**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The objectives of this course are

- To understand the concept of Bayes' theorem.
- To learn about operations on single and multi-random variables.
- To find the cross correlation and autocorrelation of signals.
- To learn about various types of oscillators.

Course Outcomes: At the end of the course the student will be able to

CO1: Compute probabilities and conditional probabilities of events defined on a sample space.

CO2: Compute statistical averages of one random variable using probability density and distribution functions and also transform random variables from one density to another.

CO3: Identify different types of random variables and compute statistical averages of these random variables using probability density and distribution functions and also perform multiple transformations of multiple random variables.

CO4: Determine stationary and ergodicity and compute correlation and covariance of a random process.

CO5: Compute and sketch the power spectrum of the response of a linear time-invariant system excited by a band pass/band-limited random process.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: Probability Theory: Sample spaces, Events, Probability definition and Axioms, Mathematical model of experiments, Probability as relative frequency, Joint and conditional probability, Properties of joint probability and conditional probability, Total probability, Bayes' theorem, independent events: Two events and multiple events, properties of independent events.

UNIT-II: Random Variables and Operations on one random variable: Random variable concept, Distribution function, Density function, Gaussian random variable, Conditional distribution and density function, Expectation, Moments, Functions that give moment, Transformations of a random variable.

UNIT-III: Multiple random variables: Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, statistical independence, Distribution and density of a sum of random variables, Central limit theorem. Operations on multiple random variables: Expected values of a function of random variables: Joint moments about the Origin, joint central moments, Joint characteristic functions, Jointly Gaussian random variables: Two random variables, n-random variables, properties of Gaussian random variables, Transformations of multiple random variables: One function, Multiple functions, Inequalities of Chebyshev and Schwartz.

UNIT-IV: Random Processes: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Function and their properties, Weiner-Kin chine Theorem ,Gaussian Random Processes, Poisson Random Process.

UNIT-V: Linear Systems with Random Inputs: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes.

Text Books:

1. Probability Theory and Random Signal Principles, Peyton Z. Peebles, 4th edition Tata McGrew Hill Publishers,2002.
2. Probability Theory and Random Processes, S. P. Eugene Xavier, S. Chand and Co. New Delhi, 1998 (2nd Edition).

Reference Books:

1. Fundamentals of Applied Probability and Radom processes, Oliver Crib, Elsevier Publications, 2007.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Probability theory and Stochastic Processes, B. PrabhakaraRao, T.S.R. Murthy, BS Publications, Hyderabad, 2012.

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EC2202 - ELECTROMAGNETIC FIELD THEORY AND TRANSMISSION LINES (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2202	**Electromagnetic Field Theory and Transmission Lines**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The objectives of this course are

- To Define the Basic Electrostatic and Magneto static Law Derive the Maxwell's Equation and apply to the basic electromagnetic problem.
- To analyze the boundary conditions, at the interface of two different media and also time varying electric and magnetic fields.
- To explain the wave propagation in different types of mediums and also transmission line fundamentals.
- To demonstrate the smith chart-configuration.

Course Outcomes: At the end of the course the student will be able to

CO1: To evaluate the design and problem-solving skills and Able to define electrostatic and magneto static laws

CO2: Able to derive the Maxwell's equations in static and dynamic fields

CO3: Able to describe energy density on electric/magnetic fields' and poynting theorem.

CO4: Able to analyze the EM wave propagation in different mediums

CO5: Able to relate the wave propagation through transmission lines and compute the impedance using smith chart for matching the load impedance.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: Electrostatics: Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy density, Convection and Conduction Currents,

Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance. Magneto statics: Biota-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductances and Magnetic Energy.

UNIT-II: Maxwell's Equations: Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Related Problems.

UNIT-III: Electromagnetic Waves: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem

UNIT-IV: Transmission Lines: Introduction to Transmission line equations, Primary & Secondary constants Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Loss lessness /Low Loss Characterization, Distortion, Loading, SC and OC Lines, Reflection Coefficient, VSWR, λ/8, λ/4, λ/2-line impedance Transformations, Smith Chart – Configuration and Applications.

UNIT-V: Waveguides: Introduction, Rectangular Waveguides, electric and magnetic field patterns in TE10 and TE11 mode configuration, modes of TE wave in rectangular waveguide, field equations, impossibility of TEM wave propagation in waveguides, cutoff frequency of rectangular waveguide, propagation constant, wave impedance, phase velocity, group velocity, dominant mode and degenerate modes, related problems.

Text Books:

1. Electromagnetic Field Theory and Transmission Lines, GottapuSasibhushana Rao, Wiley India Pvt. Ltd., New Delhi, 1st Ed.,2012.

2. Electromagnetics with Applications, Kraus and Flesch, McGraw Hill, 1999.

3. Electromagnetic Field Theory and Transmission Lines, G.S.N. Raju, Pearson Education (Pvt., Ltd., New Delhi, 2005.

Reference Books:

1.Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.

2. Engineering Electromagnetics, W. H. Hayt Jr., McGraw Hill – New York.

3. EM Waves and Radiating Systems, E. C. Jordan, PHI, 1997.

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EC2203 - MICROPROCESSORS AND MICROCONTROLLERS (PC)

(*(Effective from Admitted Batch of 2022-23)*

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2203	Microprocessors and Microcontrollers	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To know the internal organization, addressing modes and instruction sets of 8086 processor.
- To master the assembly language programming using concepts like assembler directives, procedures, software interrupts etc.
- To familiarize with the 8051 Instruction sets and addressing modes.
- To know the various peripheral devices such as 8255, 8279, 8251 and 8259.

Course Outcomes: At the end of the course the student will be able to

CO1: Realize the architecture and working of 16-bit microprocessor 8086.

CO2: Apply assembly language programming skills to perform arithmetic, logical, string, stack and interrupt operations with 8086.

CO3: Understand the interfacing of memory and different peripherals with 8086 microprocessors.

CO4: Outline the architectural features of advanced microprocessors and summarize the basic concepts of 8051 microcontroller.

CO5: Comprehend the architecture and instruction set of PIC and ARM microcontroller.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: 8086/8088 Microprocessors: Register organization of 8086, Architecture, signal description of 8086, physical memory organization, general bus operation, I/O addressing capability, special purpose activities, Minimum mode, maximum mode of 8086 system and timings, the processor 8088, machine language instruction formats, addressing mode of 8086, instruction set off 8086, assembler directives and operators.

UNIT-II: Programming With 8086 Microprocessors: Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines, interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrupt programming.

UNIT-III: Basic And Special Purpose Programmable Peripherals And Their Interfacing With 8086/88: Semiconductor memory interfacing, dynamic RAM interfacing, interfacing i/o ports, PIO 8255 modes of operation of 8255, interfacing to D/A and A/D converters, stepper motor interfacing, control of high power devices using 8255.Programmable interrupt controller 8259A, the keyboard /display controller8279, programmable communication interface 8251 USART, DMA Controller 8257.

UNIT-IV: Advanced Micro Processors: Salient features of 0386DX, architecture and signal description of 80386, register organization of 80386 and addressing modes, data types of 80386, real address mode of 80386, protected mode of 80386, segmentation and Paging, virtual 8086 mode and enhanced mode. Instruction set of 80386.The coprocessor 80387.

UNIT-V: 8051 Microcontrollers: Introduction to microcontrollers, 8051Microcontrollers, 8051pin description, connections, I/O ports and memory organization, MCS51addressing modes and instructions, assembly language programming tools. PIC Microcontrollers and ARM 32-BIT Microcontroller: Overview and features, PIC16Cx/7X instructions, interrupts in PIC 16C61/71, PIC 16F8XX Flash controllers, I/O ports and timers. Introduction to 16/32 Bit processors, ARM architecture and organization, ARM / Thumb programming model, ARM / Thumb instruction set.

Text Books:

1. A.K. Ray, K.M. Bhurchandi," Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.

2. N. Sentil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.

Reference Books:

1. Ajay V Deshmukh," Microcontrollers", TATA McGraw Hill publications, 2012.

2. Krishna Kant, "Microprocessors and Microcontrollers", PHI Publications, 2010.

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EC2204 - LINEAR ICS & APPLICATIONS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2204	Linear ICs & Applications	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To understand & learn the measuring techniques of performance parameters of OP-AMP.
- To learn the linear and non-linear applications of operational amplifiers.
- To understand the analysis & design of different types of active filters using op-amps.
- To learn the internal structure, operation and applications of different analog ICs.
- To Acquire skills required for designing and testing integrated circuits.

Course Outcomes: At the end of the course the student will be able to

CO1: Outline the fundamental concepts of an operational amplifier.

CO2: Make use of an op-amp to design linear and non-linear circuits and Analyze and design Signal Conditioning Circuits using op-amp.

CO3: Analyze and design active filters using op-amp.

CO4: Develop timers and PLL's by making use of 555 and 565 linear IC's.

CO5: Differentiate various types of DAC's and ADC's using op-amp.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: Operational Amplifiers: Design Aspects of Monolithic Op-Amps, Ideal Characteristics, AC and DC Characteristics, Data sheet Specifications, Offset Voltages and Currents, Frequency Compensation Techniques, Measurement of Op-Amp Parameters.

UNIT-II: Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers, Op-Amp

Phase Shift, Wein-bridge and Quadrature Oscillator, Voltage Controlled Oscillators, Voltage to Current and Current to Voltage Converters., Analog Multiplexers.

UNIT-III: Signal Conditioning Circuits: Rectifiers, Peak Detection and, Wave form Generators, Sample and Hold Circuits, Multivibrators, Square Wave Generators, Schmitt trigger. Active Filters: LPF, HPF, BPF, BEF, All-pass Filters, Higher Order Filters and their Comparison, Switched Capacitance Filters.

UNIT-IV: Special ICs: 555 Timers, 556 Function Generator ICs and their Applications, Three Terminal IC Regulators, IC 1496 (Balanced Modulator), IC 565 PLL and its Applications, Function Generators, Voltage to Frequency and Frequency to Voltage Converters.

UNIT-V: Digital to Analog and Analog to Digital Converters: DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs-parallel Comparator type ADC, Counter type ADC, Successive approximation ADC and dual type ADC, DAC and ADC specifications, Integrated ADC and DACs.

Text Books:

1. Op-Amps and Linear ICs- Ramakanth Gayakwad, PHI, 1987.
2. Linear Integrated Circuits- D. Roy Chowdhury, New Age International(p) Ltd,2nd Edition, 2003.

Reference Books:

1. Integrated Circuits- Botkar, Khanna Publications.
2. Applications of Linear ICs- Clayton.
3. Microelectronics-Jacob Millman.

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EC2205 - PULSE AND DIGITAL CIRCUITS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2205	Pulse and Digital Circuits	4			30	70	100	3hrs	3

Course Objectives: The objectives of this course are

- To understand the concept of wave shaping circuits, Switching Characteristics of diode and transistor.
- To study the design and analysis of various Multivibrators.
- To understand the functioning of different types of time-base Generators.
- To learn the working of logic families.

Course Outcomes: At the end of the course the student will be able to

CO1: Outline the response of linear wave shaping circuits for the standard inputs.

CO2: Extend the applications of diodes and transistors to non-linear wave shaping.

CO3: Understand the operation, analysis and design of Bistable multivibrators using BJTs and make use of basic electronic components to design monostable and astable multivibrators.

CO4: Categorize the operation of various time base generators.

CO5: Realization of logic gates using different logic families.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: Linear Wave Shaping: High pass and Low pass RC circuits, Response of High pass and Low pass RC circuits to sinusoidal, step, pulse, square, exponential and Ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator. Attenuators and its application as CRO probe, RL and RLC Circuits and their response for step input, Ringing Circuit.

UNIT-II: Nonlinear Wave Shaping: Diode clippers, Transistor Clippers, clipping at two independent levels, Comparator, Applications of voltage Comparators, Diode Comparator,

Clamping Operation, Clamping Circuits using Diode with Different Inputs, Clamping Circuit Theorem, Practical Clamping circuits, Effect of diode Characteristics on Clamping Voltage.

UNIT-III: Multivibrators: Transistor as a switch, switching times of a transistor, Design and Analysis of Fixed-bias and self-bias transistor binary, commutating capacitors, Triggering schemes of Binary, Transistor Schmitt trigger and its applications. Bistable, Monostable and Astable Multivibrators: Design and analysis of Collector coupled Monostable Multivibrator, Expression for the gate width and its waveforms. Design and analysis of Collector coupled Astable Multivibrator, expression for the Time period and its waveforms, The Astable Multivibrator as a voltage to frequency convertor.

UNIT-IV: Time Base Generators: General features of a time-base signal, Methods of Generating time base waveform, Exponential voltage sweep circuit, Basic principles of Miller and Bootstrap time base generators, transistor Miller sweep generator, transistor Bootstrap sweep generator, Current Sweep circuit, Linearity correction through adjustment of driving Waveform.

UNIT-V: Synchronization and Frequency Division: Principles of Synchronization, Frequency division in sweep circuit, Synchronization of Astable Multivibrators, Synchronization of a sweep circuit with symmetrical signals, Sine wave frequency division with a sweep circuit. LOGIC GATES**:** Realization of gates using diodes and Transistors, RTL, DTL.

Text Books:

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition 1991.
2. Pulse switching and digital circuits – David A. Bell, PHI ,5thEdn., oxford university press.

References Books:

1. Pulse and Digital Circuits, K. VenkatRao, Pearson Education India, 2nd Edition, 2010.
2. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.

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EC2206- MICROPROCESSORS AND MICROCONTROLLERS LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2206	**Microprocessors and Microcontrollers Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives: The objectives of this course are

- To study programming based on 8086 microprocessor and 8051 microcontrollers.
- To study 8086 microprocessor-based ALP using arithmetic, logical and shift operations.
- To study modular and Dos/Bios programming using 8086 microprocessors.
- To study to interface 8086 with I/O and other devices.
- To study parallel and serial communication using 8051 microcontrollers.

Course Outcomes: At the end of the course the student will be able to

CO1: Build basic assembly language programs based on arithmetic operations using 8086 microprocessors.

CO2: Develop basic assembly language programs based on arithmetic, logical, shift and string operations using MASM32 assembler.

CO3: Execution of DOS/BIOS interrupts with 8086 microprocessors using MASM32 assembler.

CO4: Implementing basic assembly language programs of 8051 microcontroller using KEIL simulator.

CO5: Construct standalone applications by Interfacing I/O peripheral devices with 8086 microprocessors.

SYLLABUS

(with effect from 2022-23 admitted Batch)

List of Experiments:

I.8086 ESA-86/88 KIT PROGRAMMING

1. Write a Program to add two 16-bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

2. Write a Program to divide two 16-bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

3. Write a Program to multiply two 16-bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

4. Write a Program to add two 32-bit numbers stored in two memory locations 2000h and 2004h and store the result in another memory location 2008h.

5. Write a program to find factorial of a given number.

II. 8086 PROGRAMMING USING MASM32 ASSEMBLER

6. Write a program to perform addition operation on two multi byte numbers.

7. Write a program to perform subtraction operation on two multi byte numbers.

8. Write a program to sort a given set of hexadecimal numbers.

9. Write a program to find whether the given string is a palindrome or not.

10. Write a program for inserting an element at a specified location in a given string.

11. Write a program to convert BCD numbers into equivalent binary value. Write a subroutine for the conversion.

12. Write a program to read a keyboard and display the characters on the PC screen using DOS/BIOS commands.

III. 8051 PROGRAMMING USING KEIL SIMULATOR

13. Write a program to generate a square wave of 50% duty cycle at pin P2.1 using timer 0 in mode1.Assume XTAL=11.0592MHz.

14. Write a program to send a message “WELCOME” serially at 9600 baud rate continuously through serial port of 8051.

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EC2207 - LINEAR ICS & PULSE CIRCUITS LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2207	**Linear ICs & Pulse Circuits Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives: The objectives of this course are

- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function ICs.
- To Gain the practical hands-on experience on 555 Timer applications.
- To Gain the practical hands-on experience on 723 Voltage Regulator and Three terminal voltage regulators.

Course Outcomes:

CO1: Design various linear & non-linear wave shaping circuits.

CO2: Basic characteristics of op-amp parameters and its measurements, design compensating circuits.

CO3: Develop applications using linear and nonlinear characterization of OPAMP.

CO4: Understand the functionality of IC723 and determine the load and line regulations

CO5: Design Multivibrator circuits using IC555.

SYLLABUS

(with effect from 2022-23 admitted Batch)

List of Experiments:

1. Design and verify Linear wave shaping circuits.
2. Design and verify Non-linear wave shaping circuits.
3. Design and verify bistable multivibrator using transistors.
4. Design UJT as a Relaxation oscillator.
5. Measurement of Operational Amplifier parameters.

6. Design Schmitt trigger circuit using Op-amp.
7. Design active filters and find its Frequency response characteristics.
8. Design and verify Op-amp as Wave form generator.
9. Design IC-555 as Astable Multi-vibrator.
10. Design of Instrumentation Amplifier and verify its gain.
11. Observe the Voltage regulation characteristics of IC-723.
12. Design Monostable Multi-vibrator using IC-555.

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EC2208- ELECTRONIC CIRCUIT SIMULATION (SC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2208	**Electronic Circuit Simulation**	**1**		**2**	**50**	**50**	**100**	**3hrs**	**2**

Course Objectives: The objectives of this course are

- To Verify Electronic devices and Circuits experiments.
- To Verify Analog Electronics and Circuits experiments.
- To Verify Analog Communication experiments
- To Verify Digital Communication experiments.

Course Outcomes: At the end of the course the student twill be able to

CO1: Understand concepts of different electronic circuit simulation software tools.
CO2: Design and verify VI characteristics of Basic electronic circuits.
CO3: Design and test frequency analysis characteristics of electronic circuits.
CO4: Analyze analog communication systems.
CO5: Analyze different multiplexing systems and Implement basic Digital communication system.

SYLLABUS

(with effect from 2022-23 admitted Batch)

I. EDC Experiments

(Simulate the following experiments using different electronic circuit simulation tools)

1. Design and plot VI Characteristics of a Zener Diode.
2. Design and test a Full Wave Rectifier using diode and to draw its performance characteristics.
3. Design and plot the Input and output characteristics of a Bipolar Junction Transistor (BJT) in Common Emitter (CE) configuration.
4. Design and plot the Drain and Transfer characteristics of a Junction Field Effect Transistor.

5. Design and plot the input and output characteristics of a Bipolar Junction Transistor (BJT) in Common Emitter (CB) configuration.

II. Analog Electronics & Circuits Experiments:

(Simulate the following experiments using different electronic circuit simulation tools)

1. Common emitter and common source Amplifier.
2. Two stage RC coupled Amplifier.
3. RC Phase shift oscillator using transistors.
4. Class-B Push-pull Amplifier.
5. Construct and Test Clipper & Clamper using discrete components.

III. Analog communication and Digital communication Experiments:

(Simulate the following experiments using different electronic circuit simulation tools)

1. Simulate AM modulation and demodulation system.
2. Simulate FM modulation and demodulation system.
3. Observe the process of Pulse Amplitude Modulation and Demodulation.
4. Analyze the process of frequency division multiplexing and frequency division demultiplexing.
5. Study of quantization and PCM technique.

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EC2209- ENVIRONMENTAL SCIENCE (MC)

(Common for all Branches)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 2209	**Environmental Science**					**100**	**100**	**3hrs**	**0**

Course Objectives: The objectives of this course are

- To Familiarize the fundamental aspects of environment and the environmental management.
- To Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- To Make realize the importance of natural resources management for the sustenance of the life and the society.
- To Apprise the impact of pollution getting generated through the anthropogenic activities on the environment.
- To Provide the concept of Sustainable Development, energy and environmental management.
- To Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes: At the end of the course the student will be able to

CO1: Knowledge on the fundamental aspects of environment and the environmental management and the knowledge on the salient features of the important international conventions.

CO2: Understanding of the importance of natural resources management for the sustenance of the life and the society.

CO3: Familiarity on various forms of pollution and its impact on the environment.

CO4: Understand the elements of Sustainable Development, energy and environmental management.

CO5: Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT-I: Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of international conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

UNIT-II: Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide- watershed management. Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings. Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams: benefits and costs. Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

UNIT-III: Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems. Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

UNIT-IV: Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

UNIT-V: Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their

principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

UNIT-VI: Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Base, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India.
3. Masters, G. M., &Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB).
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

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EC3101- CONTROL SYSTEMS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3101	**Control Systems**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The main objectives of this course are given below

- To introduce the concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems, and concepts of feedback.
- To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis.
- To develop the acquaintance in analyzing the system response in time-domain and frequency domain in terms of various performance indices.
- To analyze the system in terms of absolute stability and relative stability by different approaches.

Course Outcomes: At the end of the course the student will be able to

CO 1: Develop the transfer function using block diagram algebra and signal flow graph methods.

CO 2: Construct the mathematical model of the physical feedback control systems.

CO 3: Realize the Time Domain Analysis of Control Systems and analyze the Concepts and Necessary Conditions for Stability of control systems.

CO 4: Evaluate the stability of control systems using time and frequency response methods.

CO 5: Analyze system's absolute, relative, local stability using different frequency domain methods.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Basic Structure of a Feedback Control System Introduction to Mathematical Modeling of Physical Systems – Equations of Electrical Networks – Modeling of Mechanical Systems – Equations of Mechanical Systems, Analogous Systems.

UNIT – II: Transfer Functions of Linear Systems – Impulse Response of Linear Systems – Block Diagrams of Control Systems – Signal Flow Graphs (Simple Problems) – Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples).

UNIT – III: Time Domain Analysis of Control Systems – Time Response of First and Second Order Systems with Standard Input Signals – Steady State Error Constants – Effect of Derivative and Integral Control on Transient and Steady State Performance of Feedback Control Systems.

UNIT -IV: Concept of Stability and Necessary Conditions for Stability – Routh-Hurwitz Criterion, Relative Stability Analysis, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).

UNIT – V: Correlation between Time and Frequency Responses – Polar Plots – Bode Plots – Log Magnitude versus Phase Plots – All Pass and Minimum Phase Systems – Nyquist Stability Criterion – Assessment of Relative Stability – Constant M and N Circles.

Text Books:

1. Automatic Control Systems, Benjamin C. Kuo, PHI Publication (5th Edition).
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.

Reference Books:

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Principles and Design, M.Gopal, McGrawHill.

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EC3102- DIGITAL COMMUNICATIONS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3102	Digital Communications	4			30	70	100	3hrs	3

Course Objectives:

- To understand different pulse digital modulation techniques and their comparison.
- To familiarize various digital modulation techniques and calculation of their error probabilities.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To understand concept of spread spectrum communication system.

Course Outcomes:

CO 1: Differentiate the various types of pulse digital modulation techniques.

CO 2: Outline the band pass digital modulation and demodulation techniques.

CO 3: Evaluate the performance of digital communication system in the presence of noise.

CO 4: Analyze various receivers and determine the probability of error for various digital modulation techniques.

CO 5: Classify the different spread spectrum modulation techniques.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Analog-to-Digital Conversion: Pulse modulation techniques, Sampling, Time Division Multiplexing, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation, Digital Modulation Techniques: Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Continuously Variable Slope Delta Modulation, Companding, Noise in Pulse-Code and Delta-Modulation Systems.

UNIT – II: Bandpass Transmission: Binary Phase-Shift Keying, Differential Phase-Shift Keying, Differentially-Encoded PSK (DEPSK), Quadrature Phase-Shift Keying (QPSK), M-ary PSK, Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift-Keying, Similarity of BFSK and BPSK, M-ary FSK, Minimum Shift Keying (MSK), Duo-binary Encoding.

UNIT – III: Mathematical Representation of Noise: Some Sources of Noise, Frequency-Domain Representation of Noise, The Effect of Filtering on the Probability Density of Gaussian Noise, Spectral Components of Noise Response of a Narrowband Filter to Noise, Effect of a Filter on the Power Spectral Density of Noise, Superposition of Noises, Mixing Involving Noise, Linear Filtering, Noise Bandwidth, Quadrature Components of Noise, Power Spectral Density of n(t) and n(t), Probability Density of n(t), n(t), and their Time Derivatives, Representation of Noise Using Orthonormal Coordinates, Irrelevant Noise Components.

UNIT – IV: Data Transmission: A Base-band Signal Receiver, Probability of Error, The Optimum Filter, White Noise: The Matched Filter, Probability of Error of the Matched Filter, Coherent Reception: Correlation, Phase-Shift Keying, Frequency-Shift Keying, Non-coherent Detection of FSK, Differential PSK, Four Phase PSK (QPSK), Error Probability for QPSK, Probability of Error of Minimum Shift Keying (MSK), Comparison of Modulation Systems.

UNIT – V: Spread Spectrum Modulation: Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division, Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences, Acquisition (Coarse Synchronization) of a FH Signal, Tracking (Fine Synchronization) of a FH Signal, Acquisition (Coarse Synchronization) of a DS Signal, Tracking of a DS Signal.

Text Books:

1. Analog and Digital Communication Systems by Martin S. Roden, 3rd edition, Prentice Hall, 1994.
2. Principles of Communications by Taub and Schilling.

Reference Books:

1. Modern Analog and Digital Communications by B. P. Lathi, Oxford reprint, 3rd Edition, 2004.
2. Digital and Analog Communication systems by Samshanmugam, John Wiley, 2005.
3. Principles of Digital Communications- J. Das, SK. Mullick, P. K. Chatterjee.

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EC3103- INTERNET OF THINGS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3103	**Internet of Things**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- Vision and Introduction to Internet of Things (IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Course Outcomes: At the end of the course, student will be able to

CO 1: Explain in a concise manner how the general Internet as well as Internet of Things work.

CO 2: Understand constraints and opportunities of wireless and mobile networks for Internet of Things.

CO 3: Use basic sensing and measurement and tools to determine the real-time performance of network of devices.

CO 4: Develop prototype models for various applications using IoT technology.

CO 5: To understand data acquisition and storage process in IOT applications.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Internet of Things Overview: Introduction to Internet of things, IoT Conceptual Framework, IoT Architecture View, Technology Behind IoT, Sources of IoT, M2M Communication, Examples of IoT, IoT/M2M Systems layers and Desing Standardization, Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway.

UNIT – II: Design Principles for Web Connectivity: Introduction, Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected Devices Network using Gateway, SOAP, REST, HTTP RESTful and WebSocket, Internet Connectivity, Internet- Based Communication, IP Addressing in the IoT, Media Access Control, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT – III: Data Processing and Analytics: Introduction, Data Acquiring and Storage, Organising the Data, Transactions, Business Processes, Integration and Enterprise Systems, Analytics, Knowledge Acquiring, Managing and Sorting Process, Cloud Computing Paradigm for Data Collection, Storage and Computing, Cloud Service Models, IoT Cloud -Based Services Using the Xively, Nimbits and Other Platforms.

UNIT – IV: Prototyping the Embedded Devices for IoT and M2M: Introduction, Embedded Computing Basics, Embedded Platforms for Prototyping: Arduino, Intel® Galileo, Intel® Edison, Raspberry Pi, BeagleBone, mBed boards and Computing Systems, Things Always Connected to the Internet/Cloud, Prototyping Embedded Device Software, Devices, Gateways, Internet and Web/Cloud Services Software-Development.

UNIT – V: Business Models and Processes Using IoT: Introduction, Business Models and Business Model Innovation, Value Creation Scenarios for Internet of Things, Business Model Scenarios for Internet of Things.

Text Books:

1. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education.

2. Internet of Things, A. Bahgya and V. Madisetti, University Press,2015.

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley.

2. Getting Started with the Internet of Things, Cuno Pfister, Oreilly.

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EC3104 Program Elective-I

(Refer Annexure-I for Syllabus details)

EC3105 Open Elective-I

(Refer Annexure-II for Syllabus details)

EC3106- DIGITAL COMMUNICATION LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3106	**Digital Communications Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- A/D and D/A Converters.
- Continuously Variable Slope Delta Modulation
- Phase Shift Keying (PSK) Modulator
- Frequency Shift Keying (PSK) Modulator.

Course Outcomes:

CO 1: Practically verifying A/D and D/A Converters.

CO 2: Practically Analyze Continuously Variable Slope Delta Modulation

CO 3: Practically know the concept of Phase Shift Keying (PSK) Modulator.

CO 4: Practically understand the concepts of Frequency Shift Keying (PSK) Modulator.

CO 5: Practically verify Encoding and Decoding schemes.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Experiments:

1. Sample the given input signal for different sampling rates and recover the signal by means of appropriate low – pass filter.
2. Study the Pulse – Width Modulation for both AC and DC Modulating Signals and obtain the corresponding waveforms.
3. Study the Pulse – Position Modulation for both AC and DC Modulating Signals and obtain the corresponding waveforms.
4. Study the functioning of a given Analog to Digital Converter.
5. Study the functioning of a given Digital to Analog Converter.

6. Encode the given 4-Bit Data Word into 16-Bit Orthogonal Encoded Word using Hadamard Code.

7. Decode the 16-Bit Orthogonal Encoded Word to 4-Bit Data Word.

8. Study the performance of the given Continuously Variable Slope Delta Modulation (CVSD).

9. Obtain the characteristics of the Phase Shift Keying (PSK) Modulator.

10. Obtain the characteristics of the Frequency Shift Keying (FSK) Modulator.

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EC3107- INTERNET OF THINGS LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3107	Internet of Things Lab			3	50	50	100	3hrs	1.5

Course Objectives:

- Interface Arduino to ZigBee module.
- Interface Arduino to GSM module.
- Interface sensors to Raspberry Pi module.
- Design an IoT system.

Course Outcomes:

CO 1: Interface Arduino to ZigBee module and GSM modules.

CO 2: Interface Arduino Bluetooth modules.

CO 3: Make use of Cloud platform to upload and analyse any sensor data.

CO 4: Use of Devices, Gateways and Data Management in IoT.

CO 5: Use the knowledge and skills acquired during the course to build and test a complete working IoT system involving prototyping, programming and data analysis.

SYLLABUS

(with effect from 2022-23 admitted Batch)

List of Experiments:

1. Introduction to Arduino platform and programming.
2. Interfacing Arduino to Zigbee module.
3. Interfacing Arduino to GSM module.
4. Interfacing Arduino to Bluetooth Module.
5. Introduction to Raspberry PI platform and python programming.
6. Interfacing sensors to Raspberry PI.
7. Communicate between Arduino and Raspberry PI using any wireless medium.
8. Setup a cloud platform to log the data.
9. Log Data using Raspberry PI and upload to the cloud platform.
10. Design an IOT based system.

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EC3108- OBJECT ORIENTED PROGRAMMING THROUGH JAVA (SC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3108	**Object Oriented Programming Through JAVA**	**1**		**2**	**50**	**50**	**100**	**3hrs**	**2**

Course Objectives:

- To write programs using abstract classes.
- To write programs for solving real world problems using java collection frame work.
- To write multithreaded programs.
- To write GUI programs using swing controls in Java.
- To introduce java compiler and eclipse platform.
- To impart hands on experience with java programming.

Course Outcomes:

CO 1: Able to write programs for solving real world problems using java collection frame work.

CO 2: Able to write programs using abstract classes.

CO 3: Able to write multithreaded programs.

CO 4: Able to write GUI programs using swing controls in Java.

CO 5: Apply validation techniques to build a reliable solution to a given problem.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Programs:

1. Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatterand code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and afor loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange

buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.

3. a) Develop an applet in Java that displays a simple message.

   b) Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked.

4. Write a Java program that creates a user interface to perform integer divisions. The user enterstwo numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayedin the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, theprogram would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.

5. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and 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 thevalue of cube of the number.

6. Write a Java program for the following:
   i) Create a doubly linked list of elements.
   ii) Delete a given element from the above list.
   iii) Display the contents of the list after deletion.

7. Write a Java program that simulates a traffic light. The program lets the user select one of threelights: red, yellow, or green with radio buttons. On selecting a button, an appropriate messagewith "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially, thereis no message shown.

8. Write a Java program to create an abstract class named Shape that contains two integers andan empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

9. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header,and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in

Grid Layout.

10. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).

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EC3201- ANTENNAS AND WAVE PROPAGATION (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3201	**Antennas and Wave Propagation**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand the applications of the electromagnetic waves in free space.
- To introduce the working principles of various types of antennas.
- To discuss the major applications of antennas with an emphasis on how antennas are employed to meet electronic system requirements.
- To understand the concepts of radio wave propagation in the atmosphere.

Course Outcomes:

CO 1: Understand the radiation mechanism of an antenna and identify basic antenna parameters.

CO 2: Design and analyze various types of antenna Arrays.

CO 3: Construct and Analyze HF, VHF and UHF Antennas.

CO 4: Analyze Microwave antennas and summarize the antenna measurement techniques.

CO 5: Outline the characteristics of radio wave propagation.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Radiation and Antennas: Antenna definition and Functions, Network theorems, Properties of antennas, Antenna parameters, Polarization, Basic antenna elements, Radiation mechanism, Radiation fields of alternating current element, Radiated power and radiation resistance of current element, Radiation, induction and electrostatic fields, Hertzian dipole, Different current distributions in linear antennas, Radiation from half-wave dipole, Radiation from quarter wave monopole, Radiation characteristics of dipoles.

UNIT – II: Analysis of Linear Arrays: Directional characteristics of dipole antennas, Radiation pattern of alternating current element, Radiation pattern expressions of centre-fed vertical dipoles of finite length, Radiation patterns of centre-fed vertical dipoles, Radiation patterns of centre-fed horizontal dipoles, Radiation patterns of vertical dipoles, Two-element uniform array, Uniform linear arrays, Field strength of a uniform linear array, First sidelobe ratio (SLR), Broadside and End-fire arrays, Patterns of array of non-isotropic radiators, Multiplication of patterns, Generalized expression for principle of pattern multiplication, Radiation pattern characteristics, Binomial arrays, Effect of earth on vertical patterns, Effect of earth on radiation resistance, Methods of excitation, Impedance matching techniques, Transmission loss between transmitting and receiving antennas - FRIIS formula, Antenna temperature and signal-to-noise ratio.Array Synthesis, Synthesis methods, Fourier transform method, Linear array design by Woodward-Lawson method, Dolph-chebychev method (Tschebyscheff distribution), Taylor method, Laplace transform method, Standard amplitude distributions.

UNIT – III: HF, VHF and UHF Antennas: Introduction, Isotropic radiators, Directional antennas, Omni-directional antennas, Resonant antennas, Nonresonant antennas, LF antennas, Antennas for HF, VHF and UHF, Dipole arrays, Folded dipole, V-Antennas, Inverted V-antennas, Rhombic antenna, Yagi-Uda antenna, Log-periodic antennas, Loop antenna, Helical antenna, Whip antenna, Ferrite rod antenna, Turnstile antennas, Discone antennas, Notch antenna.

UNIT – IV: Microwave Antennas and Antenna Measurements: Introduction, Rod reflector, Plane reflector, Corner reflector, Parabolic reflector, Types of parabolic reflectors, Feed systems for parabolic reflectors, Shaped beam antennas, Horn antennas, Corrugated horns, Slot antennas, Impedance of a few typical dipoles, Slots in the walls of rectangular waveguides, Babinet's principle, Lens antennas, Microstrip antennas , Measurement ranges, Indoor and outdoor ranges, Antenna impedance measurements, Measurement of radiation resistance, Gain measurements, Measurement of antenna bandwidth, Directivity measurement, Measurement of sidelobe ratio, Measurement of radiation efficiency, Measurement of antenna aperture efficiency, Measurement of polarization of antenna, Phase measurement.

UNIT – V: Wave Propagation: Propagation characteristics of EM Waves, Factors involved in the propagation of radio waves, Ground wave propagation, Ground wave field strength by Maxwell's equations, Reflection of radio waves by the surface of the earth, Roughness of earth,

Reflection factors of earth, Wave tilt of the ground wave, Tropospheric wave propagation, Atmospheric effects in space wave propagation, Duct propagation, Radio horizon, Troposcatter, Fading of EM waves in Troposphere, Line of sight (LOS), Ionospheric propagation, Characteristics of ionosphere, Refractive index of ionosphere, Phase and group velocities, Mechanism of Ionospheric propagation, reflection and refraction, Characteristic parameters of Ionospheric propagation, Sky wave field strength, Fading and diversity techniques, Faraday's rotation, Effect of earth's magnetic field.

Text Book:

1. Antennas and Wave Propagation, G.S.N. Raju, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2007.

Reference Books:

1. EM Waves and Radiation Systems, E. C. Jordan and K. G. Balmain, PHI – N. Delhi, 1997.
2. Antennas, J.D. Kraus, McGraw Hill, NY.
3. Antenna theory, C.A. Balanis, John Wiley & Sons, NY, 1982.

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EC3202- DIGITAL SIGNAL PROCESSING (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3202	Digital Signal Processing	4			30	70	100	3hrs	3

Course Objectives:

- To Analyze the Discrete Time Signals and Systems.
- To understand the various implementations of digital filter structures.
- To know the importance of FFT algorithm for computation of Discrete Fourier Transform.
- To learn the FIR and IIR Filter design procedures.
- To know the applications of DSP.

Course Outcomes:

CO 1: Apply the concepts of difference equations to Analyze the discrete time systems

CO 2: Make use of the FFT algorithm for solving the DFT of a given signal.

CO 3: Analyze the Digital IIR & FIR filter design for different specifications.

CO 4: Analyze the Digital FIR filter design for different specifications.

CO 5: Understand the signal Processing concepts in various applications.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Discrete - Time Signals and Systems: Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Causality, Linear Constants – Coefficient Difference Equations, Frequency Domain Representation of Discrete – Time Signals and Systems.

UNIT – II: Applications of Z – Transforms: System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters, Finite Word Length Effects.

UNIT – III: Discrete Fourier Transform (DFT): Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences. Fast – Fourier Transforms (FFT): Radix – 2 Decimation – In – Time (DIT) and Decimation – In – Frequency (DIF), FFT Algorithms, Inverse FFT.

UNIT – IV: IIR Digital Filter Design Techniques: Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

UNIT – V: Design of FIR Filters: Fourier series Method, Window Function Techniques, Comparison of IIR and FIR Filters. Applications of FFT in Spectrum Analysis and Filtering, Application of DSP in Speech Processing.

Text Book:

1. Alan V. Oppenheim and Ronald W. Schafer: Digital Signal Processing, PHI.

Reference Books:

1. Sanjit K. Mitra, Digital Signal Processing "A – Computer Based Approach", Tata Mc Graw Hill.
2. Raddar and Rabiner, Application of Digital Signal Processing.
3. S. P. Eugene Xavier, Signals, Systems and Signal Processing, S. Chand and Co. Ltd.
4. Antonio, Analysis and Design of Digital Filters, Tata Mc Graw Hill.

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EC3203- MICROWAVE ENGINEERING (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3203	Microwave Engineering	4			30	70	100	3hrs	3

Course Objectives:

- The microwave components.
- Microwave signal generators and amplifiers.
- Various microwave circuits and microwave integrated circuits.
- Various microwave parameter measurements.

Course Outcomes:

CO 1: Analyze the microwave components.

CO 2: Illustrate microwave signal generators and amplifiers.

CO 3: Understand the operation of various microwave circuits.

CO 4: Infer various microwave integrated circuits.

CO 5: Infer various microwave parameter measurements.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Microwave Components: Introduction to Microwaves and their applications, Coaxial Line Components, Wave-guide Components, Directional Couplers, Hybrid Tee Junction, Magic Tee, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors, Mixers.

UNIT -II: Microwave Signal Generators and Amplifiers: Vacuum Tube Triodes, Resonant Cavity Devices, Reflex Klystron, two – Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes.

UNIT – III: Microwave Circuits: Scattering Matrix and its Properties, Scattering Matrix of directional coupler, circulator, E Plane Tee, H plane Tee and Magic Tee.

UNIT – IV: Microwave Integrated Circuits: Materials, Substrate, Conductor, Dielectric and Resistive Materials, MMIC Growth, Fabrication Techniques, MOSFET Fabrication, NMOS Growth and CMOS Development, Thin Film Formation.

UNIT – V: Microwave Measurements: VSWR, Frequency, Guide Wavelength, Coupling and Directivity measurements.

Text Books:

1. Microwave Engineering, G.S.N. Raju, IK International Publishers.
2. Microwave Communications – Components and Circuits, E. Hund, McGraw Hill.
3. Microwave Devices and Circuits, S. Y. Liao, PHI.
4. Microwave Engineering, R. Chatterjee, East – West Press Pvt. Ltd.

Reference Books:

1. Foundations For Microwave Engineering, R. R. Collin, McGraw Hill.

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EC3204 - Program Elective-II
(Refer Annexure-I for Syllabus details)

EC3205 - Open Elective-II
(Refer Annexure-II for Syllabus details)

EC3206- ANTENNA SIMULATION LABORATORY (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3206	**Antennas Simulation Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- To understand the fundamental working principle of an antenna.
- To describe/explore the different antenna parameters like input impedance, far-field radiation patterns, reflection coefficient, etc.
- To apply the different feeding technique.
- To evaluate and perform the optimization to achieve a certain goal.
- To design the wire antennas, microstrip antennas, etc.

Course Outcomes:

CO 1: Understand different simulation software used for antenna design and analysis.
CO 2: Understand the design and analyzing basic antenna and its parameters experimentally.
CO 3: Design and understand wire antennas and microstrip antennas.
CO 4: Understand the different feeding technique used for antenna design.
CO 5: Design wire antennas, Microstrip antennas, and Microstrip based filters.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Experiments:

(Simulate the following experiments using different antenna simulation softwares)

1. Design of fundamental parameters of the antenna to measure different antenna parameters.
2. Design of a half-wave dipole antenna.
3. Design of a quarter-wave monopole antenna.
4. Design and simulation of rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness.

5. Design of microstrip patch antenna using a coaxial feeding technique.
6. Design and simulation of dual-band rectangular patch antenna using the inset feeding technique.
7. Design and simulation of rectangular microstrip patch antenna using CPW feeding with slot for bandwidth enhancement.
8. Design of aperture coupled rectangular microstrip patch antenna with two different substrates.
9. Design of proximity coupled rectangular microstrip patch antenna.
10. Design and simulation of Dielectric Resonator Antenna with a particular operating frequency, dielectric constant and substrate thickness.
11. Design and Simulation of Rectangular MPA.
12. Design and Simulation of Circular MPA.

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EC3207- DIGITAL SIGNAL PROCESSING LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3207	**Digital Signal Processing Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- To make familiar with practical implementation of the digital signal processing.
- To develop DSP algorithms for convolution, correlation and DFT.
- To design digital filters.
- To understand audio and image processing.

Course Outcomes:

CO 1: Generation and Implementation of discrete time signals and systems.

CO 2: Analyze the Frequency analysis of discrete signals and systems.

CO 3: Design and simulate FIR and IIR filters with different techniques.

CO 4: Analyze noise performance on audio signals.

CO 5: Understand the concepts of Digital Image Processing.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Experiments:

(Simulate the following experiments using signal processing simulation software)

1. Sampling theorem, illustration of up sampling in time and frequency domain.

2. Sampling theorem, illustration down sampling in time and frequency domain.

3. Implement

   (a) Linear Convolution of Two Sequences.

   (b) Circular Convolution of Two Sequences.

   (c) Cross-Correlation and Auto-Correlation.

4. FFT of a given (8 point and 16 point) N-point Sequence using

(a) DIF-FFT (b) DIT-FFT.

5. System Response of Discrete Time Sequences

(a) Impulse (b) Step

6. Spectral Analysis of given Waveforms. And Plot Spectrogram (Frequency v/s Time)

(a) Sinusoidal (b) Square (c) Audio file.

7. Study of Architecture of DSP Chip-TMS320C6711.

8. Design following IIR Digital Filters using i) Butterworth and ii) Chebyshev designs:

(a) LPF (b) HPF (c) BPF (d) BSF

9. Design FIR Digital Filters using a) Rectangular window b) Hamming window:

(a) LPF (b) HPF (c) BPF (d) BSF.

10. Addition of White Gaussian Noise to an Audio file and recover the Signal using Butterworth filters.

11. Perform various operations on Digital Images.

(a) Cropping (b) rotation (c) histogram (d) binary image

(e) B to G conversion (f) water marking (g) Adding noise to the image.

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EC3208- MICROWAVE ENGINEERING LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3208	**Microwave Engineering Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- VSWR.
- V-I Characteristics of GUNN Diode.
- Coupling Factor and Directivity of a 4-Port directional coupler.
- Microwave frequency

Course Outcomes:

CO 1: Measurement of VSWR.

CO 2: Experimentally analyze V-I Characteristics of GUNN Diode.

CO 3: Measure Coupling Factor and Directivity of a 4-Port directional coupler practically.

CO 4: Practically experimenting and understand radiation pattern of Horn Antenna.

CO 5: Practically analyze analog and digital fiber optic links.

SYLLABUS
(with effect from 2022-23 admitted Batch)

List of Experiments:

1. Measurement of VSWR.
2. V-I Characteristics of GUNN Diode.
3. Measurement of Coupling Factor and Directivity of a 4-Port directional coupler.
4. Measurement of Microwave frequency.
5. Reflex Klystron Characteristics.
6. Radiation Pattern of Horn Antenna.

7. Fiber Optic Analog Link.
8. Fiber Optic Digital Link.
9. Other four experiments from the choice either from Microwave Engineering or from Antenna Theory.

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EC3209- SOFT SKILLS (SC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 3209	**Soft Skills**	**1**		**2**	**50**	**50**	**100**	**3hrs**	**2**

Course Objectives:

- To develop skills to communicate clearly.
- To aid students in building interpersonal skills.
- To enhance team building and time management skills.
- To inculcate active listening and responding skills.

Course Outcomes:

CO 1: Make use of techniques for self-awareness and self-development.

CO 2: Apply the conceptual understanding of communication into everyday practice.

CO 3: Understand the importance of teamwork and group discussions skills.

CO 4: Develop time management and stress management.

CO 5: Preparation of resume and interviews.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to Soft Skills: Communication – Verbal and Non-Verbal Communication - Personal grooming (Etiquette, Attitude, Body Language), Posture, Gestures, Facial Expressions, Eye Contact, Space Distancing, Presentation Skills, Public Speaking, just a Minute (JAM) sessions, Adaptability.

UNIT - II: Goal Setting and Time Management: Immediate, Short term, Long term, Smart Goals, Strategies to Achieve goals, Types of Time, Identifying Time Wasters, Time Management Skills, Stress Busters.

UNIT – III: Leadership and Team Management: Qualities of a Good Leader, Team Dynamics, Leadership Styles, Decision Making, Problem Solving, Negotiation Skills.

UNIT – IV: Group Discussions: Purpose (Intellectual ability, Creativity, Approach to a problem, Tolerance), Group Behaviour, Analysing Performance.

UNIT – V: Job Interviews: Identifying job openings, Covering Letter and CVs / Resumes, Interview (Opening, Body-Answer Q, Close-Ask Q), Telephone Interviews, Types of Questions.

Reference Books:

1. Krannich, Caryl, and Krannich, Ronald L. Nail the Resume! Great Tips for Creating Dynamite Resumes. United States, Impact Publications, 2005.
2. Hasson, Gill. Brilliant Communication Skills. Great Britain: Pearson Education, 2012
3. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Education, 2001.
4. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.
5. Rizvi, Ashraf M. Effective Technical Communication: India, McGraw-Hill Education. 2010
6. Thorpe, Edgar &Showick Thorpe. Winning at Interviews. 2nd Edition. Delhi: Dorling Kindersley, 2006.

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EC4101 - Program Elective-III

(Note: Refer Annexure-I for Syllabus details)

EC4102 - Program Elective-IV

(Note: Refer Annexure-I for Syllabus details)

EC4103 - Program Elective-V

(Note: Refer Annexure-I for Syllabus details)

EC4104 - Open Elective-III

(Note: Refer Annexure-II for Syllabus details)

EC4105 - Open Elective-IV

(Note: Refer Annexure-II for Syllabus details)

EC4106 - HSS Elective

(Note: Refer Annexure-III for Syllabus details)

EC4107- WEB TECHNOLOGIES (SC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 4107	WEB Technologies	1		2	50	50	100	3hrs	2

Course Objectives:

- To develop an ability to design and implement static and dynamic website.
- Create conforming web pages.
- Understand, analyze and create XML documents and XML Schema.
- Understand, analyze and build web applications using PHP.
- Handling Cookies and Sessions using PHP, SERVLETS and JSP.

Course Outcomes:

CO 1: Design and implement dynamic websites with good aesthetic sense of designingand latest technical know-how's.

CO 2: Create web pages using HTML and Cascading Styles sheets.

CO 3: Analyze a web page and identify its elements and attributes.

CO 4: Create dynamic web pages using JavaScript.

CO 5: Build web applications using PHP.

SYLLABUS

(with effect from 2022-23 admitted Batch)

List of Programs:

1. Design the following static web pages required for an online book storeweb site.

   i) HOME PAGE: The static home page must contain three frames.

   ii) LOGIN PAGE

   iii) CATOLOGUE PAGE: The catalogue page should contain thedetails of all the books available in the web site in a table.

   iv) REGISTRATION PAGE

2. Write a JavaScript to validate the following fields of the Registrationpage.

   i) First Name (Name should contains alphabets and the lengthshould not be less than 6 characters).
   ii) Password (Password should not be less than 6 characters length).
   iii) E-mail id (should not contain any invalid and must follow thestandard pattern name@domain.com)
   iv) Mobile Number (Phone number should contain 10 digits only).
   v) Last Name and Address (should not be Empty).

3. Develop and demonstrate the usage of inline, internal and externalstyle sheet using CSS.

4. Develop and demonstrate JavaScript with POP-UP boxes andfunctions for the following problems:

   i) Input: Click on Display Date button using onclick () function.
   Output: Display date in the textbox.

   ii) Input: A number n obtained using prompt.
   Output: Factorial of n number using alert.

   iii) Input: A number n obtained using prompt.
   Output: A multiplication table of numbers from 1 to 10 of n using alert.

   iv) Input: A number n obtained using prompt and add another numberusing confirm.
   Output: Sum of the entire n numbers using alert.

5. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).

6. Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

7. Develop and demonstrate PHP Script for the following problems:

   i) Write a PHP Script to find out the Sum of the Individual Digits.

ii) Write a PHP Script to check whether the given number isPalindrome or not.

8. Implement the web applications with Database using PHP.

9. Modify the above PHP program to use an xml instead of database.

10. Write a program to design a simple calculator using (i) JavaScript (ii)PHP**.**

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EC4201- PROJECT WORK

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
EC 4201	**Project Work**				**100**	**100**	**200**		**14**

Course Outcomes:

CO 1: Apply critical and creative thinking in the design of engineering projects, plan and manage your time effectively as a team.

CO 2: Consider the business context and commercial positioning of designed devices or systems and apply knowledge of the real-world situations that a professional engineer can encounter.

CO 3: Use fundamental knowledge and skills in engineering and apply it effectively on a project and design and develop a functional product prototype while working in a team.

CO 4: Undertake an engineering project under mentorship and timely reflect on your own and peer's technical and non- technical learning.

CO 5: Orally present and demonstrate your product to peers, academics, generally and industry community and manage any disputes and conflicts within and outside your team.

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ANNEXURE -I

PROFESSIONAL ELECTIVES (PE)

1. Global Positioning System.
2. Radar Engineering.
3. Cellular Mobile Communication.
4. Electronic Measurements and Instrumentation.
5. Data Structures.
6. EMI/EMC.
7. Internet and Web Technology.
8. Speech Processing.
9. Computer Networks.
10. TV and Satellite Communication System.
11. Transducers and Signal Conditioning.
12. VLSI Design.
13. Digital Image Processing.
14. Fiber Optic Communication.
15. Advanced Microprocessors.

GLOBAL POSITIONING SYSTEM (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Global Positioning System	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- Global Position System with GPS working principle.
- Other global satellite constellations.
- GPS satellite constellation and signals.
- Block diagrams of Synthetic Aperture Radar (SAR), Phased array Radars and others.
- different coordinate systems

Course Outcomes:

CO 1: Understand the basic concepts of Global Position System with GPS working principle.

CO 2: Understand the basic concepts of other global satellite constellations.

CO 3: Analyze various GPS Errors.

CO 4: Analyze GPS satellite constellation and signals.

CO 5: Examine different coordinate systems.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to GPS: Global Position System, the History of GPS, the Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites.

UNIT – II: GPS Working: Principal Trilateration, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or X-Y Plane, Determining the receiver position in 3D or X-Y-Z Plane, basic equations for finding user position, user position determination with least squares estimator.

UNIT – III: Other Global Satellite Constellation: GLONASS, GALILEO, Comparison of 3GNSS (GPS, GALILEO, GLONASS) in terms of constellation and services provided.

UNIT – IV: GPS Satellite constellation and Signal Structure: GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code, P code Navigation data, Signal structure of GPS.

UNIT – V: Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system, Conversion between Cartesian and geodetic coordinate frame.

Text Books:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010.
2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006.

Reference Books:

1. Scott Gleason and Demoz Gebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.
2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).
3. B. Hoffmann- Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

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RADAR ENGINEERING (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Radar Engineering	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To study the principles of operation of various blocks of Radar systems and Radar Range equation in detail.
- To study the functions of various blocks of CW Radar, FM-CW Radar, MTI and Pulse Doppler Radars, Tracking radar and their limitations and applications.
- To study the functions of various blocks of Radar receivers and detection of Radar signals in noise in detail.
- To study the principles and working of phased array antennas and their application to radar systems.

Course Outcomes:

CO 1: Understand the basic concepts of Radar, equation and factors influencing radar range equation.

CO 2: Knowledge of different types of radars and understand the detection criteria for different parameters.

CO 3: Distinguish the fixed and moving targets using different types of radar systems. Analyze Tracking Radar.

CO 4: Examine block diagrams of Synthetic Aperture Radar (SAR), Phased array Radars and others.

CO 5: Knowledge about different radar transmitters and receivers and identify the different types of display devices & duplexers used in radar receivers.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to RADAR: Radar Equation, Radar Block Diagram and Operation, Prediction of Range, Minimum Detectable Signal, Receiver Noise, Probability Density Functions,

S/N, Integration of Radar Pulses, Radar Cross-section, Transmitter Power, PRF and Range Ambiguities, Radar Antenna Parameters, System Losses and Propagation Effects.

UNIT - II: MTI and Pulse Doppler RADAR: Introduction, Delay line Cancellers, Moving target Detector, Limitation to MTI performance, MTI from moving platform, Pulse Doppler Radar.

UNIT – III: Tracking RADARS: Sequential Lobing, Conical Scan, Monopulse tracking Radar, Low angle tracking, Pulse compression, Block Diagrams of Synthetic Aperture Radar (SAR), Phased array Radars, MST Radar, ECM, ECCM.

UNIT – IV: Detection of Signals in Noise: Matched Filter Receiver, Detection Criteria, Constant False Alarm Rate Receivers. Information From RADAR Signals: Basic Radar Measurements, Pulse Compression, Target Recognition.

UNIT – V: RADAR Transmitters and Receivers: Magnetron, Solid State RF Power Source, Other Aspects of Radar Transmitters, Radar Receiver, Superheterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays.

Text Book:

1. Radar Engineering and Fundamentals of Navigational Aids, G S N Raju, IK International Publishers, 2008.

Reference Book:

1. Introduction to Radar Systems, Skolnik, McGraw Hill, 2007.

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CELLULAR AND MOBILE COMMUNICATION (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Cellular and Mobile Communication	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To know the evolution of Mobile communication and cell concept to improve capacity of the system.
- Understand the basic cellular concepts like frequency reuse, cell splitting, cell sectoring etc., and various cellular systems.
- Understand the frequency management, channel assignment, various propagation effects in cellular environment and the concepts of handoff and types of handoffs.
- Understand the architectures of GSM and 3G cellular systems.

Course Outcomes:

CO 1: Able to know the evolutions in wireless technologies.

CO 2: Understand different modulation techniques used in mobile communications.

CO 3: Analyze the fundamental concepts of cellular radio systems and its basic elements.

CO 4: Analyze various mobile radio propagation models.

CO 5: Able to know standards and system architectures of radio interface such as GSM and IMT-2000

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction: Evolution of Mobile Communications, Mobile Radio Systems around the world, First, Second, Third Generation Wireless Networks, Wireless Local Loop (WLL), Wireless LANs, Bluetooth, Personal Area Networks (PANs), Examples of Wireless Communication Systems, A Simplified Reference Model, Applications.

UNIT – II: Wireless Transmission Techniques: Frequencies for radio transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulation Techniques: ASK, PSK, FSK, Advanced

ASK, Advanced PSK, Multicarrier, Spead Spectrum: Direct sequence and Frequency hopping, Medium Access control- SDMA, FDMA, TDMA, CDMA, Comparison of S/F/T/CDMA.

UNIT – III: The Cellular Concept: Introduction, Frequency reuse, Handoff strategies, Interference and System Capacity: Co- Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference, Trunking and Grade of Service, Cell Splitting, Sectoring, Repeaters for Range extension, A microcell zone concept.

UNIT – IV: Mobile Radio Propagation: Introduction, Free space propagation model, The three basic propagation models-Reflection, Diffraction and Scattering, Two-ray model, Outdoor propagation models, Indoor propagation models, Signal Penetration into building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small scale fading.

UNIT -V: Telecommunication Systems: GSM: Mobile Services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, Security, New data services, UMTS and IMT-2000: Releases and Standardization, System Architecture, Radio interface, UTRAN, Handover.

Text Books:

1. Mobile Cellular Communication by Gottapu Sasibhushana Rao, PEARSON International, 2012.

Reference Books:

1. Mobile Communications-Jochen Schiller, Pearson education, 2nd Edn, 2004.
2. Wireless Communications: Principles and Practice-Theodore. S. Rapport, Pearson education, 2nd Edn, 2002.
3. Mobile Cellular Telecommunications-W.C.Y. Lee, Tata McGraw Hill, 2nd Edn, 2006.
4. Wireless and Mobile Communications-Lee, McGraw Hill, 3rd Edition, 2006.
5. Wireless Communications and Networks-William Stallings, Pearson Education, 2004.

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ELECTRONIC MEASUREMENTS & INSTRUMENTATION (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Electronic Measurement and Instrumentation	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To introduce the fundamentals of Electronics Instruments and Measurement
- To provide an in-depth understanding of Measurement errors.
- To address the underlying concepts and methods behind Electronics measurements.
- To understand operation of different instruments.
- To know the principles of various types of transducers and sensors.

Course Outcomes:

CO 1: Understand the different characteristics of electronic measuring instruments.

CO 2: Make use of Signal generators to analyze a signal.

CO 3: Understand the design and functioning of Oscilloscopes.

CO 4: Utilize AC bridges for measurement of inductance and distinguish active transducers from passive transducers.

CO 5: Develop the ability to use instruments for measurement of physical parameters.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Basic Measurement Concepts: Measurement systems – Static and dynamic characteristics – error analysis – moving coil meters – DC ammeters, DC voltmeters, Series type ohmmeter, Shunt type ohmmeter, multimeter - moving iron meters – Bridge measurements – Wheatstone, Kelvin, Guarded Wheatstone, Maxwell, Hay, Schering, Anderson and Wein bridge.

UNIT – II: Basic Electronic Measurements: AC voltmeters using rectifiers, True RMS responding voltmeter, Electronic multimeter – Comparison of analog and digital techniques – digital voltmeter - Ramp, Stair case ramp, Integrating, Continuous balance, Successive approximation.

UNIT -III: Digital Instruments: Frequency counters – measurement of frequency and time interval – extension of frequency range – measurement errors - Cathode ray oscilloscopes – block schematic – applications – special oscilloscopes – Storage and sampling oscilloscopes – wave analyzer - distortion analyzer - spectrum analyzer – Q meters.

UNIT -IV: Transducers: Introduction, Classification of transducers, Analog transducers, Resistive transducers, Potentiometers, Strain gauges, Types of strain gauges, Resistance strain gauges, Semiconductor strain gauges, Resistance thermometers, Thermometers, Application of Thermistors, Thermo-couple construction, Measurement of thermocouple output, Compensating circuits, Advantages and disadvantages of thermocouples.

UNIT – V: Displacement Transducers: Variable inductance type transducer, Variation of self-inductance, Variation of mutual inductance, Linear variable differential transformer, Rotary variable differential transformer, Capacitive transducers, Piezo-electric transducers, Digital transducers, Shaft Encoder.

Text Books:

1. Albert D. Helfrick and William D. Cooper – Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 2003.
2. A K Sawahney, Electrical and Electronics Measurement and Instrumentation, Dhanpat Rai,2000

Reference Books:

1. H S Kalsi, Electronic instrumentation, TMH, 1995.
2. Ernest O. Doebelin, Measurement Systems- Application and Design-Tata McGraw-Hill-2004.
3. Oliver B.M. & Cage – Electronic Measurements & Instrumentation -Tata McGraw Hill
4. K Padma Raju,Y J Reddy, Instrumentation and Control Systems, McGraw Hill Education,2016.

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DATA STRUCTURES (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Data Structures	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course objectives:

- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps binary search trees, and graphs and writing programs for these solutions.

Course outcomes:

CO 1: Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithm.

CO 2: Demonstrate different methods for traversing trees.

CO 3: Compare alternative implementations of data structures with respect to performance.

CO 4: Discuss the computational efficiency of the principal algorithms for sorting and searching.

CO 5: Understand the concepts of Topological Ordering of nodes, Graph Traversal.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to Data Structures: Review of C Programming, Recursive Definition and Processes, Recursion in C, Simulation of Recursion, Efficiency of Recursion, Abstract Data Types, Meaning and Definition of Data Structures, Arrays.

UNIT – II: Stacks: Stack as an Abstract Data Type, Primitive Operations, Implementing Stack Operations using Arrays, Infix, Postfix and Prefix: Definitions, Evaluation and Conversions. Queues: Queue as an Abstract Data Type, Sequential Representation, Types of Queues,

Operations, Implementation using Arrays. Linked List: Operations, Implementation of Stacks, Queues and priority Queues using Linked Lists+, Circular Lists: Insertion, Deletion and Concatenation Operations, Stacks and Queues as Circular Lists, Doubly Linked Lists.

UNIT – III: Trees: Binary Trees - Definitions and Operations, Binary Tree Representation: Node Representation, Implicit array Representation, Binary Tree Traversal, Threaded Binary Trees and their Traversal, Trees and their Applications; Tree Searching: Insertion and Deletion of a node from a Binary Search Tree, Efficiency of Binary Search Tree operations.

UNIT - IV: Searching: Basic Searching Techniques: Dictionary as an Abstract Data Type, Algorithmic Notation, Sequential Searching and its Efficiency, Binary Search, Interpolation Search. Sorting: General Background: Efficiency, Asymptotic Notations, Efficiency of Sorting, Bubble Sort and Quick Sort and their Efficiency, Selection Sorting, Binary Tree Sort, Heap Sort, Insertion Sorts, Shell Sort, Address calculation Sort, Merge and Radix Sorts.

UNIT – V: Graphs and Their Application: Definition of Graphs, Representation of Graphs, Transitive closure, Linked Representation of Graphs, Topological Ordering of nodes, Graph Traversal and Spanning Forests, Undirected Graphs and their Traversals, Applications of Graphs, Minimal Spanning Trees.

Textbooks:

1. Data Structures Using C and C++ Yddish Langsam, Moshe J. Augenstein and Aaron M. Tanenbaum, Prentice Hall of India (2nd Edition)

2. Data Structures, Algorithms and Applications with C++, Sahani Mc-Graw Hill

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EMI/EMC (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	EMI/EMC	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To familiarize with the fundamentals that are essential for electronics industry in the field of EMI / EMC
- To understand EMI sources and its measurements
- To understand the various techniques for electromagnetic compatibility.
- Acquire broad knowledge of various EM radiation measurement techniques.
- Model a given electromagnetic environment/system so as to comply with the standards.

Course Outcomes:

CO 1: Understand the EMI sources, EMC regulations and methods of eliminating interferences.

CO 2: Identifying of EMI hotspot and various techniques like Grounding, Shielding, Cabling.

CO 3: Analyze the effect of EM noise in system environment and its sources.

CO 4: Summarize the EMC design constraints and make appropriate trade-offs that meets all requirements.

CO 5: Differentiate various EMI measurement techniques.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to EMI/EMC: EMI Sources, EMI Coupling, Noise Path, Models of Noise Coupling, EMC Regulations, Designing for EMC, Compliance Tests, Elimination of EMI, EMI Testing, Compliance Test and Engineering Tests.

UNIT – II: Grounding Techniques: Grounding Techniques, Shielding Techniques, Cabling Techniques.

UNIT – III: Conducted EMI/EMC: Origin of Conducted EMI, Common and Normal mode Noise, Noise from Power Electronic Systems, Spectra of Pulse Noise Sources, Modeling of EMI Noise Sources, Transient Disturbance Simulation Signals, EMI Filters for Mains Noise.

UNIT -IV: Choice of Passive Components: EMC Design Components

UNIT -V: EMI Measurement Technology: EMI Measuring Instruments, Pitfalls of EMI Measurements, Test Instrumentation Accessories and their Characteristics, Measurement of Pulsed EMF, EMI Patterns from Different List Objects, EMI Immunity Test System, Software in EMI/EMC Measurements, Recent Trends in Susceptibility Measurement, Cost Effective EMI/EMC Measurements, Setup and its Maintenance.

Text Books:

1. IMPACT Learning Material Series Modules 1 – 9, IIT New Delhi, Published by RSTE.
2. Electromagnetic Compatibility, R. C. Paul.

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INTERNET & WEB TECHNOLOGY (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Internet & WEB Technology	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand best technologies for solving web client/server problems.
- To analyze and design real time web applications.
- To use Java script for dynamic effects and to validate form input entry.
- To Analyze to Use appropriate client-side or Server-side applications.

Course Outcomes:

CO 1: Understand the concepts of HTML, Java scripts and Cascading Style Sheets

CO 2: Generate XML documents and Schemas and summarize Java Beans.

CO 3: Develop and deploy real time web applications in web servers and Servlets.

CO 4: Build JSP tools that assist in automating data transfer over the Internet.

CO 5: Accessing a Database from Servlets & JSP Page.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets; Java Script: - Introduction to Java Scripts, Objects in Java Script**,** Dynamic HTML with Java Script. XML, Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.

UNIT – II: Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK, Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's

UNIT -III: Web Servers and Servlets: Tomcat web server, Introduction to Servlets: Lifecycle of a Server let, The Servlet API, The javax.servelet Package, Reading Servlet parameters, and

Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues

UNIT – IV: JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations

UNIT – V: Database Access: Database Programming using JDBC, Studying Javax.sql. *Package, accessing a Database from Servlets & JSP Page, Application – Specific Database Actions, Deploying JAVA Beans in a JSP Page, Introduction to struts framework.

Text Books:

1. Internet and World Wide Web – How to program by Dietel and Nieto
   PHI/Pearson Education Asia.
2. Advanced Java™ 2 Platform How to Program, Deitel/Deitel/Santry 3. Java Server Pages –Hans Bergsten, SPD O'Reilly

Reference Books:

1. HTML Black Book: The Programmer's Complete HTML Reference Book-by Steven Holzner
2. Core Servelets and Java Server Pages Volume2: Core Technologies by Marty Hall and Larry Brown, Pearson Education.

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SPEECH PROCESSING (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Speech Processing	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand the basic principles of sound and speech production and perception.
- To understand basic principles of speech recognition, synthesis and dialogue systems
- To obtain an introductory overview in the field.

Course Outcomes:

CO 1: Model an electrical equivalent of Speech Production system.

CO 2: Convey details of a range of commonly used speech feature extraction techniques.

CO 3: Provide a basic understanding of multidimensional techniques for speech representation and classification methods.

CO 4: Familiarize you with the practical aspects of speech processing, including robustness, and applications of speech processing, including speech enhancement, speaker recognition and speech recognition.

CO 5: Design a Homomorphic Vocoder for coding and decoding of speech

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.

UNIT – II: Time Domain Models for Speech Processing: Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech Vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing

approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT – III: Linear Predictive Coding (LPC) Analysis: Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT -IV: Homomorphic Speech Processing: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder. Speech Enhancement: Nature of interfering sounds, Speech enhancement techniques: Single Microphone Approach: spectral subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi microphone Approach.

UNIT - V: Automatic Speech & Speaker Recognition: Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Hidden Markov Model (HMM) for Speech: Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS. Speaker Recognition: Recognition techniques, Features that distinguish speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System.

Text Books:

1. L.R. Rabiner and S. W. Schafer, "Digital Processing of Speech Signals", Pearson Education.
2. Douglas O'Shaughnessy, "Speech Communications: Human & Machine", 2nd Ed., Wiley India, 2000.
3. L.R Rabinar and R W Jhaung, "Digital Processing of Speech Signals", 1978, Pearson Education.

Reference Books:

1. Thomas F. Quateri, “Discrete Time Speech Signal Processing: Principles and Practice”, 1st Edition., PE.
2. Ben Gold & Nelson Morgan, “Speech & Audio Signal Processing”, 1st Edition, Wiley.

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COMPUTER NETWORKS (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Computer Networks	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To describe how computer networks are organized with the concept of layered approach.
- To implement a simple LAN with hubs, bridges and switches.
- To analyze the contents in a given Data Link layer packet, based on the layer concept.
- To design logical sub-address blocks with a given address block.
- To describe how routing protocols work.

Course Outcomes:

CO 1: Understand the concepts of Network Topologies, structures, layers, physical layer Guided Transmission media and Multiplexing concepts.

CO 2: Understand how the Media Access control problem solved in a network using multiple access protocols.

CO 3: Detect and analyze the Datalink layer Framing, Error control Techniques and protocols in a network.

CO 4: Make use of the Network Layer routing algorithms, congestion control algorithms to perform better network communication.

CO 5: Analyze the internet Transport layer protocols and application layer services.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction: Uses of Computer Networks, Network Structure, Architectures, Services, Standardization, Functions of Various Network Layers, Network examples. Physical

layer -Theoretical Basis for Data Communication, Transmission Media, Analog and Digital Transmission, Transmission and Switching ISDN.

UNIT – II: Medium Access Sub-layer: LAN, MAN, Protocol, ALOHA, IEEE Standard for 802 for LANs, Fiber Optic Networks, Satellite Networks.

UNIT – III: Data Link layer: Design Issues, Error Detection and Correction, Protocols and their Performance, Specifications and Examples.

UNIT -IV: Network layers: Design Considerations, Difference between Gateway, Ethernet Switch, Router, Hub, Repeater, Functions of Router, Congestion Control Internetworking and Examples, Details of IP addressing schemes, TCP/IP Protocol details.

UNIT – V: The Transport Layer: The Transport Service, Elements of Transport Protocols, The Internet Transport Protocols; UDP, The Internet Transport Protocols; TCP. The Application Layer -The Domain Name System, Electronic Mail, The World Wide Web.

Text Books:

1. Data Communications and Networking by Behrouz A. Forouzan, 2nd Edition, Tata McGraw Hill.

Reference Books:

1. Computer Networks, A. S. Tannenbaum, PHI – New Delhi.
2. Computer Networking Terminology Products and Standards, R. P. Suri and J. K. Jain, Tata McGraw Hill.

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TV AND SATELLITE COMMUNICATION SYSTEM (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	TV and Satellite Communication System	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- basic television system.
- With examples of Signal Transmission and Channel Bandwidth
- Television Receiver and Colour Television
- various concepts of satellite communication.

Course Outcomes:

CO 1: Analyze the concepts of basic television system.

CO 2: Illustrate examples of Signal Transmission and Channel Bandwidth.

CO 3: Understand the different television camera principles and receiver circuits.

CO 4: Infer Television Receiver and Colour Television.

CO 5: Infer various concepts of satellite communication.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Basic Television System: Sound and Picture Transmission, the Scanning Process, Interlaced Scanning, Number of Scanning Lines, Vertical and Horizontal Resolution, Bandwidth of the Baseband Picture Signal. Composite - Video Signal, Video signal levels, Need for Synchronization, Details of Horizontal and Vertical Sync Pulses, Equalizing Pulses.

UNIT – II: Signal Transmission and Channel Bandwidth: AM and FM Channel Bandwidth, VSB Transmission, Complete Channel Bandwidth, Reception of Vestigial Sideband Transmission, Television Standards, Block Schematic study of a typical TV Transmitter.

UNIT -III: The TV Picture Tube: Monochrome Picture Tube, Picture Tube Characteristics and Picture Tube Control Circuits, Gamma Correction. Television Cameras: Principle of working and constructional

details of Image Orthicon, Vidicon, Plumbicon and Silicon diode array Vidicon and Solid-state Image Scanners. Television Receiver: Block Schematic and Functional Requirements, VSB Correction. Vertical and Horizontal Deflection Circuits, E.H.T. Generation, Study of Video IF Amplifier Video Detector, Sound Channel Separation, Sync Separation Circuits.

UNIT – IV: Colour Television: Principles of Additive and Subtractive Colour Mixing, Chromaticity Diagram, Compatibility and Reverse Compatibility of Colour and Monochrome TV Requirements, Colour Signal Transmission, Bandwidth for Colour Signal Transmission, Sub-carrier Modulation of Chroma Signals, NTSC Encoding (Y, I, Q signals), PAL Encoding (Y, U, V signals), NTSC and PAL Decoders, Types of Colour TV Picture Tubes (Delta-gun, PIL and Trinitron Picture Tubes), Convergence Techniques.

UNIT – V: Satellite Communication: Orbital Aspects, Tracking and Control of Communication Satellites, Launch Vehicles, Propagation Characteristics: Attenuation and Noise, Frequency Bands, Satellite Transponders, Earth Station: Configuration, High Power Amplifiers, Antennas, LNA, Link Design, Multiple Access: FDMA, TDMA, CDMA, SPADE, INTELSATs, INSAT.

Text Books:

1. Global Navigation Satellite Systems with Essentials of Satellite Communications authored by G S Rao, Mc-Graw Hill Publication, New Delhi 2010
2. Monochrome and Colour Television, R. R. Gulati, Wiley Eastern.

Reference Books:

1. Television Engineering, A. M. Dhake, Tata - McGraw Hill.
2. Satellite Communication, D. C. Agarwal, Khanna Publishers.
3. Satellite Communication, T. Pratt and S. W. Bostian, John Wiley and Sons.

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TRANSDUCERS AND SIGNAL CONDITIONING (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Transducers and Signal Conditioning	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand the necessity and advantages of transducer.
- To learn the operation and applications of various transducer.
- To design and construct different transducers.
- To measure several parameters using transducers.

Course Outcomes:

CO 1: Understand study about the concepts of measurement, error and uncertainty, transducer classification, terminology, static and dynamic characteristics of transducers.

CO 2: Gain knowledge on working principle construction, operation, characteristics and features of different transducers.

CO 3: Understand the concepts of signal conversion and signal conditioning methods for different transducers.

CO 4: Understand the selection criteria of transducer for particular application and use the same for developing the applications.

CO 5: Design and understand the signal conditioning circuits.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction: Measurement systems, Basic electronic measuring system, Transduction principles, Classification of transducers, General transducers characteristics, Criteria for transducer selection.

UNIT – II: Resistive Transducers: Principles of operation, construction, theory, advantages and disadvantages, applications of Potentiometers, strain gauges, (metallic and semi-conductor type), Resistance Thermometer, Thermistors. Inductive Transducers: Types of Inductive transducer,

Principles of operation, construction, Advantages & disadvantages and applications. Various variable Inductive Transducers, LVDT (Linear variable differential transformer). Capacitive Transducers: Types of capacitive transducer, Principles of operation, construction, theory, advantages and disadvantages and applications, of capacitive transducers based upon familiar equation of capacitance.

UNIT – III: Active Transducers: Principle of operation, construction, theory, advantages and disadvantages and applications of following transducers: Thermocouple, Piezo-electric transducer, Magneto-strictive transducer, Hall effect transducer, Photo-voltaic transducer and electrochemical transducer.

UNIT - IV: Other Transducers: Optical transducers: photo-emissive, photo-conductive and Photovoltaic cells, Digital Transducers: Optical encoder, Shaft encoder. Feedback fundamentals, introduction to Inverse transducer. Elastic Transducers: Spring bellows, diaphragm, bourdon tube – their special features and application.

UNIT – V: Signal Conditioning: Concept of signal conditioning, Applications of AC/DC Bridges, Application of Op-amp circuits used in instrumentation, Instrumentation amplifiers, Interference, grounding, and shielding.

Text Books:

1. Murty DVS, “Transducers & Instrumentation”, Prentice Hall of India
2. Sawhney AK, “Electrical and Electronics Measurements and Instrumentation,” Dhanpat Rai and Sons
3. Kalsi HS, “Electronic Instrumentation,” Tata McGraw Hill

4. Patranabis D, “Sensors and Transducers,” Prentice Hall of India 5. Doebelin EO, “Measurement Systems: Application and Design,” Tata McGraw Hill

Reference Books:

1. H.K.P. Neubert Instrument Transducers Oxford University Press: (Second edition).

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VLSI DESIGN (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	VLSI Design	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- VLSI technology
- circuit design processes with stick diagrams and layout diagrams.
- VLSI circuit
- scaling of MOS circuits with sub system design and layout

Course Outcomes:

CO 1: Describe the basic concepts of VLSI technology.

CO 2: Demonstrate circuit design processes with stick diagrams and layout diagrams.

CO 3: Understand the aspects of design tools, testability and practical design for guidelines.

CO 4: Demonstrate basic circuit concepts.

CO 5: Summarize scaling of MOS circuits with sub system design and layout.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT - I: Review of microelectronics and an introduction to MOS technology: Introduction to IC technology, MOS and related VLSI technology, NMOS, CMOS, BiCMOS Technologies, Thermal aspects of processing, Production of E beam marks.

UNIT – II: MOS and BiCMOS circuit design processes: MOS layers, Stick diagrams, Design rules, and layout, 2 & 1.2 micro meter CMOS rules, Layout diagrams, Symbolic diagram. Basic Circuit concepts - Sheet resistance, Area capacitances of layers, Delay unit, Wiring Capacitances, Choice of layers. Scaling of MOS Circuits -Scaling models, Scaling function for device parameters, Limitations of scaling.

UNIT – III: Sub system design and Layout: Architectural issues, Switch logic, Examples of Structural design (Combinational logic). Sub system design process Design of ALU subsystem, some commonly used storage elements, Aspects of design tools, Design for testability, Practical design for test guidelines, Built in self-test, CMOS project-an incrementor / decrementer, a comparator for two n-bit numbers. Ultra-fast systems, Technology development, MOSFET based design.

UNIT – IV: Introduction to Embedded Systems: Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded Systems on Chip, Complex Systems Design and Processors, Design Process in Embedded System, Formalization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills required for an Embedded System Designer.

UNIT – V: Embedded Software Development Process and Tools: Introduction to Embedded Software Development Process and Tools, Host and Target Machines, Linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware-Software Design and Co-design

Text books:

1. Basic VLSI Design by Douglas A, Pucknell, Kamran Eshraghian, Prentice-Hall, l996, 3rd Edition.
2. Embedded Systems Architecture, Programming and Design, second edition by Raj Kamal, Tata McGraw Hill Publication (Chapter 1, Chapter 13)

Reference Books:

1. Mead, C.A and Conway, LA, "Introduction to VLSI Systems", Addison-Wesley, Reading, Massachusetts, l980.

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DIGITAL IMAGE PROCESSING (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Digital Image Processing	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To familiarize with basic concepts of digital image processing and different image transforms
- To learn various image processing techniques like image enhancement, restoration, segmentation and compression
- To understand color fundamentals and different color models.
- To understand wavelets and morphological image processing.

Course Outcomes:

CO 1: Illustrate the fundamental concepts of Digital Image Processing and different image transforms.

CO 2: Analyze the effect of spatial and frequency domain filtering of images.

CO 3: Evaluate the methodologies for image restoration and reconstruction.

CO 4: Compare the different color image processing techniques.

CO 5: Categorize different image segmentation techniques and morphological image operations.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction: Origins of digital image processing, uses digital image processing, fundamental steps in digital image processing, components of an image processing system, digital image fundamentals, Elements of visual perception, light and electromagnetic spectrum, imaging sensing and acquisition, image sampling and quantization. Some basic relationships between pixels, and introduction to the mathematical tools used in digital image processing.

UNIT – II: Image Transforms: Need for image transforms, Spatial Frequencies in image processing, introduction to Fourier transform, discrete Fourier transform, fast Fourier transform and its algorithm, properties of Fourier transform. Discrete sine transforms. Walsh Transform. Hadamard transform, Haar Transform. Slant transforms, SVD and KL Transforms or Hotelling Transform

UNIT -III: Intensity Transformations and Spatial Filtering: Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods, using fuzzy techniques for intensity transformations and spatial filtering. Filtering in the frequency domain, Preliminary concepts, Sampling and the Fourier transform of sampled functions, the discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform. The Basic of filtering in the frequency domain, image smoothing using frequency domain filters, Selective filtering, Implementation.

UNIT – IV: Image restoration and Reconstruction: A model of the image degradation /Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimation the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filtering, image reconstruction from projections. Image compression: Fundamentals, various compression methods-coding techniques, digital image water marking. Image segmentation: Fundamentals, point, line, edge detection thresholding, region –based segmentation, segmentation using Morphological watersheds, the use of motion in segmentation. Color image processing, Color fundamentals, color models, pseudo color image processing, basic of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

UNIT – V: Wavelets and Multi-resolution Processing: image pyramids, sub band coding & Haar transforms multi resolution expressions, wavelet transforms in one dimension. The fast wavelets transform, wavelet transforms in two dimensions, wavelet packets. Morphological image processing: preliminaries Erosion and dilation, opening and closing, the Hit-or-miss transformation, some Basic Morphological algorithms, grey –scale morphology

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. R. C. Gonzalez, R. E. Woods and Steven L. Eddins, Digital Image Processing Using MATLAB, 2rd edition, Prentice Hall, 2009.
3. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
4. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw-Hill Education.

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SMART ANTENNA SYSTEMS (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Smart Antenna Systems	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To know the basic concepts on antenna.
- To know the performance of an antenna array.
- Learning self-adaptive procedure to extract the desired signal.
- Design of smart antenna system.

Course Outcomes:

CO 1: Understand antenna theory and application of signal processing in smart antennas.

CO 2: Analyze DOA estimation methods.

CO 3: Learn techniques of developing MIMO antennas.

CO 4: Understand different beam forming techniques.

CO 5: Analyze space time processing techniques.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Smart Antennas: Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.

UNIT – II: DOA Estimation Fundamentals: Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Autocovariance, Conventional DOA Estimation Methods, Conventional Beamforming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation, MUSIC Algorithm, ESPRIT Algorithm, Uniqueness of DOA Estimates.

UNIT – III: Beam Forming Fundamentals: Classical Beam former, Statistically Optimum Beamforming Weight Vectors, Maximum SNR Beam former, Multiple Sidelobe Canceller and Maximum, SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beamforming

UNIT – IV: Integration and Simulation of Smart Antennas: Overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms, DOA, Adaptive Beam forming, Beam forming and Diversity Combining for Rayleigh-Fading, Channel, Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Adhoc Networks (MANETs), Protocol, Simulations, Discussion.

UNIT – V: Space–Time Processing: Introduction, Discrete Space–Time Channel and Signal Models, Space– Time Beamforming, Inter symbol and Co-Channel Suppression, Space–Time Processing for DSCDMA, Capacity, and Data Rates in MIMO Systems, Discussion.

Text Books:

1. Constantine A. Balanis & Panayiotis I. Ioannides, "Introduction to Smart Antennas", Morgan & Claypool Publishers' series-2007
2. Joseph C. Liberti Jr., Theodore S Rappaport, "Smart Antennas for Wireless CommunicationsIS-95 and Third Generation CDMA Applications", PTR – PH publishers, 1st Edition, 1989.

Reference Books:

1. T.S Rappaport, "Smart Antennas Adaptive Arrays Algorithms and Wireless Position Location", IEEE press 1998, PTR – PH publishers 1999.
2. Lal Chand Godara, "Smart Antennas", CRC Press, LLC-20.

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ADVANCED MICROPROCESSORS (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Advanced Microprocessors	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To describe the function of the microprocessor and detail its basic operation.
- To understand the concepts of advanced architecture in the microprocessors.
- To describe the function and purpose of each program-visible registers in microprocessor.
- To interface memory devices with 80186,80286,80386 and 80486.

Course Outcomes:

CO 1: Understand the functionality of 80186,80286,80386 and 80486 architecture to design advanced microprocessors systems

CO 2: Analyze the Performance of RISC and CISC architectures.

CO 3: Interface the advanced processors with Memory.

CO 4: Understand timing and instruction cycle timings.

CO 5: Summarize the interfacing rules of different peripherals with advanced microprocessor.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: 80386 Architecture: Instruction set - Addressing modes - Real mode - Protected mode - 80386 Architecture - Address segmentation - Paging - Segment registers. Basic 486 Architecture - 486 memory system and memory management - Features of Pentium memory and I/O systems - Pentium memory management - Introduction to Pentium Pro features.

UNIT -II: High Performance CISC Architecture – Pentium: CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

UNIT – III: High Performancerisc RISC Architecture – ARM Arcon RISC Machine – Architectural Inheritance – Core & Architectures - Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors - ARM instruction set- Thumb Instruction set.

UNIT – IV: Instruction cycle timings: The ARM Programmer's model – ARM Development tools – ARM Assembly Language Programming – Optimizing ARM Assembly Code – Optimized Primitives.

UNIT-V: Memory Interface: Memory Devices, Address Decoding, 8086, 80186,80286,80386SX Memory Interface, 80286DX and 80486 Memory Interface, Pentium through core2 Memory Interface

Reference Books:

1. The Intel Microprocessors 8086 / 8088, 80186, 80188, 80286, 80386, 80486, Pentium and Pentium – Pro Processor Architecture, Programming and Interface by Barray B. Berry, 4th Edition, PHI.
2. Microprocessors Principles and Applications by Gilmore, 2nd Edition, TMH.
3. Microprocessors and Interfacing Programming and Applications by Douglas V. Hall, Mc Graw Hill.
4. Microprocessors / Microcomputers Architecture, Software and Systems by A.J. Khambata, John Wiely & Sons.
5. Advanced Microprocessors by Daniel Tabak, Mc Graw Hill, 1995.

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ANNEXURE -II

OPEN ELECTIVES (OE)

1. Low Power VLSI Design.
2. Wireless Sensor Networks.
3. Bio-Medical Instrumentation.
4. FPGA Design.
5. DSP Processors and Architectures.
6. Fiber Optic Communication.
7. GPS Principles and its Applications.
8. Mobile Cellular Communication.
9. Embedded System Design.
10. Information Theory and Coding.
11. Artificial Neural Networks.
12. Data Science.
13. Artificial Intelligence and Machine Learning.

LOW POWER VLSI DESIGN (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Low Power VLSI Design	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- This course addresses a profound analysis on the development of the CMOS & Bi-CMOS digital circuits for a low voltage low power environment
- To study the concepts of device behavior and modeling
- To study the concepts of low voltage, low power logic circuits

Course Outcomes:

CO 1: Capability to recognize advanced issues in VLSI systems, specific to the deep-submicron silicon technologies.

CO 2: Students able to understand deep submicron CMOS technology and digital CMOS design styles.

CO 3: To design chips used for battery-powered systems and high-performance circuits

CO 4: Explain the equations, approximations and techniques available for deriving a device model with specified properties

CO 5: Explore and improvise on the latest techniques used for designing power-efficient logic gates, latches, and flip-flops.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Low Power Design, An Over View: Introduction to low- voltage low power design, limitations, Silicon-on-Insulator.

UNIT – II: MOS/ Bi CMOS PROCESSES: Bi CMOS processes, Integration and Isolation considerations, Integrated Analog/Digital CMOS Process. Deep submicron processes, SOI CMOS, lateral BJT on SOI, future trends and directions of CMOS/ Bi CMOS processes.

UNIT – III: Device Behavior and Modeling: Advanced MOSFET models, limitations of MOSFET models, bipolar models. Analytical and Experimental characterization of sub-half micron MOS devices, MOSFET in a Hybrid mode environment.

UNIT – IV: CMOS and Bi-CMOS Logic Gates: Conventional CMOS and Bi CMOS logic gates. Performance evaluation.

UNIT – V: Low- Voltage Low Power Logic Circuits: Comparison of advanced BiCMOS Digital circuits. ESD-free Bi CMOS, Digital circuit operation and comparative Evaluation. Low Power Latches and Flip Flops, Evolution of Latches and Flip flops-quality measures for latches and Flip flops, Design perspective.

Text Books:

1. CMOS/Bi CMOS ULSI low voltage, low power by Yeo Rofail / Gohl (3 Authors)-Pearson Education Asia 1st Indian reprint,2002

Reference Books:

1. Digital Integrated circuits, J.Rabaey PH. N.J 1996
2. CMOS Digital ICs sung-moKang and yusufleblebici 3rd edition TMH2003 (chapter 11)
3. VLSI DSP systems, Parhi, John Wiley & sons, 2003 (chapter 17)
4. IEEE Trans Electron Devices, IEEE J.Solid State Circuits, and other National and International Conferences and Symposia.

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WIRELESS SENSOR NETWORKS (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Wireless Sensor Networks	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand the WSN node Architecture and Network Architecture.
- To identify the Wireless Sensor Network Platforms.
- To design and develop wireless sensor node.
- To learn the concepts of layered protocols for WSN.

Course Outcomes:

CO 1: Understand the fundamental Concepts, applications and architectures of wireless sensor networks

CO 2: Categorize the various network topologies.

CO 3: Realize the MAC Protocols for Wireless Sensor Networks.

CO 4: Describe routing protocols for ad hoc wireless networks with respect to TCP design issues.

CO 5: Outline the transport layer and security protocols for WSN and differentiate various sensor network platforms and tools.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Overview of Wireless Sensor Networks: Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints a challenge, Driving Applications, Enabling Technologies for Wireless Sensor Networks. Architectures - Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT – II: Networking Technologies: Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.MAC Protocols for Wireless Sensor Networks - Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad-Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention – Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT – III: Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols, Proactive Routing.

UNIT – IV: Transport Layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT – V: Security in WSNs: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. Sensor Network Platforms and Tools - Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming. Applications of WSN -Ultra-wide band radio communication, Wireless fidelity systems. Future directions, home automation, smart metering Applications.

Text Books:

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani, CRC Press

3. Holger Karl & Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

Reference Books:

a. Kazem Sohraby, Daniel Minoli, &Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, and Applications”, John Wiley, 2007.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.
5. Wireless Sensor Networks – S Anandamurugan, Lakshmi Publications.

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BIO-MEDICAL INSTRUMENTATION (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Bio-Medical Instrumentation	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To know the sources of Bio-electric potentials and Electrodes.
- To analyze the cardiovascular &Respiratory systems and its related measurements.
- To understand the various techniques for electromagnetic compatibility.
- To acquire knowledge of electronics in clinical laboratory and therapeutic area.

Course Outcomes:

CO 1: Understand the origin of bio-potentials and role of its electrodes.

CO 2: Elucidate the cardiovascular system and its measurements.

CO 3: Develop a thorough understanding on principles of Patient Care Monitory and Measurements in Respiratory System.

CO 4: Outline the concepts of Bio telemetry and Instrumentation for the clinical laboratory.

CO 5: Summarize the application of Electronics in diagnostics and therapeutic area.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Sources of Bioelectric potentials: Sources of Bioelectric potentials and Electrodes Resisting and Action Potentials, Propagation of Action Potentials, The Bioelectric Potentials Electrode theory, Bio Potential Electrodes, Biochemical Transducers.

UNIT – II: The Cardiovascular System: The Cardiovascular System and Cardiovascular Measurements, The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristics of Blood Flow, Heart Sounds Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Plethysmography, Measurement of Heart Sounds,

UNIT – III: Patient Care and Monitoring: Patient Care & Monitory and Measurements in Respiratory System The elements of Intensive Care Monitory, Diagnosis, Calibration and repairability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers, defibrillators The Physiology of respiratory system, tests and instrumentation for mechanics of breathing, respiratory theory equipment.

UNIT – IV: Biotelemetry: Bio telemetry and Instrumentation for the clinical laboratory Introduction to biotelemetry, physiological parameters adaptable to biotelemetry, the components of biotelemetry system, implantable units, applications of telemetry in patient care the blood, tests on blood cells, chemical test, automation of chemical tests

UNIT – V: X-Ray and Radioisotope Instrumentation: X – ray and radioisotope instrumentation and electrical safety of medical equipment. Generation of Ionizing radiation, instrumentation for diagnostic X – rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy. Physiological effects of electrical current, shock Hazards from electrical equipment, Methods of accident prevention

Text Book:

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A. Pfeiffer Pearson education.

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FPGA DESIGN (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	FPGA Design	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To prepare the student to be an entry-level industrial standard FPGA designer.
- To give the student an understanding of issues and tools related to FPGA design and implementation.
- To give the student an understanding of basics of System on Chip and Platform based design.
- To learn and use design flow for using FPGA and using FPGA programming to design practical circuits.

Course Outcomes:

CO 1: Be able to completely understand FPGA design flow and the building blocks of commercially available FPGA/CPLDs.

CO 2: Be able to create circuits that realize specified digital functions and to identify logic and technology-specific parameters to control the functionality, timing, power, and parasitic effects.

CO 3: Develop VHDL/Verilog models and synthesize targeting for Vertex, Spartan FPGAs.

CO 4: Develop parameterized library cells and implement system designs using parameterized cells.

CO 5 Understand the concepts of routing in FPGA and analyze different routing strategies and designing of a system having a set of objective criteria & design constraints.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to FPGAs: Evolution of programmable devices, FPGA Design flow, Applications of FPGA.

UNIT – II: Design Examples Using PLDs: Design of Universal block, Memory, Floating point multiplier, Barrel shifter.

UNIT – III: FPGAs/CPLDs: Programming Technologies, commercially available FPGAs, Xilinx's Vertex and Spartan, Actel's FPGA, Altera's FPGA/CPLD.

UNIT -IV: Building blocks of FPGAs/CPLDs: Configurable Logic block functionality, Routing structures, Input/output Block, Impact of logic block functionality on FPGA performance, Model for measuring delay.

UNIT - V: Routing Architectures: Routing terminology, general strategy for routing in FPGAs, routing for row – based FPGAs, introduction to segmented channel routing, routing for symmetrical FPGAs, example of routing in a symmetrical FPGA, general approach to routing in symmetrical FPGAs, independence from FPGA routing architectures, FPGA routing structures. FPGA architectural assumptions, the logic block, the connection block, connection block topology, the switch block, switch block topology, architectural assumptions for the FPGA

Text Books:

1. John V. Old Field, Richrad C. Dorf, Field Programmable Gate Arrays, Wiley, 2008.

2. Data sheets of Artix-7, Kintex-7, Virtex-7.

3. Stephen D. Brown, Robert J. Francis, Jonathan Rose, Zvonko G. Vranesic, Field Programmable Gate Arrays, 2nd Edition, Springer, 1992.

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DSP PROCESSORS & ARCHITECTURES (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	DSP Processors & Architectures	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To learn the architecture, addressing modes of DSP processors.
- To interface the serial converters to a DSP device
- To give an exposure to the various fixed point & a floating point DSP architectures and to develop applications using these processors.
- To know different basic DSP algorithms.

Course Outcomes:

CO 1: Understand the concepts of DSP and numeric representations.

CO 2: Able to illustrate the architectural features of DSP devices.

CO 3: Knowledge about various addressing modes of DSP TMS320C54XX and determine various addressing modes and instructions of DSP processor.

CO 4: Understand the concepts of basic DSP algorithms and develops the skills for DSP programming.

CO 5: Analyzes the interfacing of serial and parallel communication devices to a DSP device.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to Digital Signal Processing: Introduction, A Digital signal-processing system, the sampling process, Discrete time sequences Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems, Computational Accuracy in DSP Implementations -Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT – II: Architectures for Programmable DSP Devices and Execution: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing

Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing, Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models

UNIT – III: Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT – IV: Implementations of Basic DSP Algorithms and FFT Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing, An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

UNIT -V: Interfacing Memory And I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

Text Books:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

Reference Books:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M.Bhaskar, TMH, 2004.
2. Digital Signal Processing – Jonatham Stein, John Wiley, 2005.

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FIBER-OPTIC COMMUNICATION (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Fiber Optic Communication	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To realize the significance of optical fibre communications.
- To understand the construction and characteristics of optical fibre cable.
- To develop the knowledge of optical signal sources and power launching.
- To identify and understand the operation of various optical detectors.
- To understand the design of optical systems and WDM.

Course Outcomes:

CO 1: Understand and analyze the constructional parameters of optical fibres.

CO 2: Estimate the losses due to attenuation, absorption, scattering and bending.

CO 3: Compare various optical detectors and choose suitable one for different applications.

CO 4: Understand different optical sources and detectors.

CO 5: Be able to design an optical system.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Overview of Optical Fiber Communication: - Historical development, The general system, Advantages of Optical Fiber Communications, Optical Fiber Wave Guides- Introduction, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays, Cylindrical Fibers- Modes, V number, Mode Coupling, Step Index Fibers, Graded Index Fibers. Single Mode Fibers- Cut Off Wavelength, Mode Field Diameter, Effective Refractive Index, Fiber Materials Glass, Halide, Active Glass, Chalgenide Glass, Plastic Optical Fibers.

UNIT – II: Signal Distortion in Optical Fibers: Attenuation, Absorption, Scattering and Bending Losses, Core and Cladding Losses, Information Capacity Determination, Group Delay, Types of Dispersion - Material Dispersion, Wave-Guide Dispersion, Polarization Mode

Dispersion, Intermodal Dispersion, Pulse Broadening, Optical Fiber Connectors- Connector Types, Single Mode Fiber Connectors, Connector Return Loss.

UNIT – III: Fiber Splicing: Splicing Techniques, Splicing Single Mode Fibers, Fiber Alignment and Joint Loss- Multimode Fiber Joints, Single Mode Fiber Joints. Optical Sources- LEDs, Structures, Materials, Quantum Efficiency, Power, Modulation, Power Bandwidth Product, Injection Laser Diodes- Modes, Threshold Conditions, External Quantum Efficiency, Laser Diode Rate Equations, Resonant Frequencies, Reliability of LED & ILD.

Source to Fiber Power Launching: - Output Patterns, Power Coupling, Power Launching, Equilibrium Numerical Aperture, Laser Diode to Fiber Coupling

UNIT -IV: Optical Detectors: Physical Principles of PIN and APD, Detector Response Time, Temperature Effect on Avalanche Gain, Comparison of Photo Detectors, Optical Receiver Operation- Fundamental Receiver Operation, Digital Signal Transmission, Error Sources, Receiver Configuration, Digital Receiver Performance, Probability of Error, Quantum Limit, Analog Receivers.

UNIT – V: Optical System Design: Considerations, Component Choice, Multiplexing, Point-to-Point Links, System Considerations, Link Power Budget with Examples, Overall Fiber Dispersion in Multi-Mode and Single Mode Fibers, Rise Time Budget with Examples. Transmission Distance, Line Coding in Optical Links, WDM, Necessity, Principles, Types of WDM, Measurement of Attenuation and Dispersion, Eye Pattern.

Text Books:

1. Optical Fiber Communications – Gerd Keiser, MC GRAW HILL EDUCATION, 4th Edition, 2008.

2. Optical Fiber Communications – John M. Senior, Pearson Education, 3rd Edition, 2009.

Reference Books:

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.

2. Text Book on Optical Fibre Communication and its Applications – S.C.Gupta, PHI, 2005. 3. Fiber Optic Communication Systems – Govind P. Agarwal, John Wiley, 3rd Ediition, 2004. 4. Introduction to Fiber Optics by Donald J.Sterling Jr. – Cengage learning, 2004.

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GPS PRINCIPLES AND ITS APPLICATIONS (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	GPS Principles and its applications	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- Different coordinate systems
- Different GPS Position Estimates.
- Other global satellite constellations.
- Global Position System with GPS working principle.
- Various GPS Errors.

Course Outcomes:

CO 1: Examine using different coordinate systems.

CO 2: Understand the basic concepts of GPS Position Estimation.

CO 3: Analyze GPS satellite constellation and signals.

CO 4: Understand the basic concepts of Global Position System with GPS working principle.

CO 5: Analyze various GPS Errors.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system, Conversion between Cartesian and geodetic coordinate frame.

UNIT- II: GPS Position Estimation Algorithm: Basic Equation for finding user position, user position determination with LSA (Least Square Approximation), Kalman Filter Algorithm Equation for GPS Position Estimation.

UNIT - III: GPS Satellite constellation and Signal Structure: GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code, P code Navigation data, Signal structure of GPS.

UNIT - IV: GPS Working: Trilateration Principal, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or X-Y Plane, Determining the receiver position in 3D or X-Y-Z Plane.

UNIT - V: GPS Errors: List out various GPS Errors, Description on Ionospheric Error, Ionospheric code and Phase Range Error determination.

Text Books:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010.
2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006.

Reference Books:

1. Scott Gleason and Demoz Gebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.
2. James Ba – Yen Tsui, **'**Fundamentals of GPS receivers – A software approach**'**, John Wiley & Sons (2001).
3. B. Hoffmann- Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

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MOBILE CELLULAR COMMUNICATION (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Mobile Cellular Communication	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- Understanding the basic principles of mobile communication systems.
- An analysis of mobile communications with the interpretation of the call prints.
- Understand the basic principles of the modern mobile and wireless communication systems.
- Understand the operation of mobile communications systems and their generation divisions.

Course Outcomes:

CO 1: Able to understand the concepts of Cellular Communication.

CO 2: Able to know different antennas and their design concepts used in base stations and mobile stations.

CO 3: Analyze the propagation mechanism and different models used in mobile communications.

CO 4: Understand Handoff and types of Handoffs used in mobile communications.

CO 5: Understand the principle and features of 5G technology in cellular systems.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to Mobile and Cellular Communication Systems

Introduction to cellular concept, Cellular Geometry, Frequency Reuse, Cell Splitting, Types of Interferences, Interference models, Reduction of co-channel interference.

UNIT – II: Mobile and Base Station Antennas

Mobile Satellite Antennas, Base station antennas, Cell Site Antennas, Microstrip Antennas, Resonant Structure of Microstrip antenna, Microstrip patch antennas, Design considerations of patch antennas.

UNIT – III: Mobile Radio Propagation and Modelling including Multiple Access Techniques

Basics of Mobile Radio Propagation, Propagation models, Free space propagation model, Types of Small-Scale Fading, Multiple Access Techniques.

UNIT – IV: Handoff Technologies

Handoff, Classification Based on Natures of Handoff, Classification Based on Purposes of Handoff.

UNIT – V: - 5G

Principle of operation of 5G Technology, Key parameters and Technical Specifications of 5G, 5G cellular system Error Correction Techniques.

Text Books:

1. Mobile and Cellular Communication (Including 5G & beyond and Microstrip Antenna) by Prof. G. Sasibhushana Rao, Raj Kumar Goswami and MNVSS Kumar, Paramount Publishers, 2024.

Reference Books:

1. Lee,W.C.Y., Mobile Cellular Telecommunications Systems Mc Grawhill.
2. Rappaport T S., Wireless Communications.

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EMBEDDED SYSTEM DESIGN (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Embedded System Design	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To introduce the Building Blocks of Embedded System and Educate in Various Embedded Development Strategies.
- To Introduce Bus Communication in processors, Input/output interfacing and to impart knowledge in various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on real time operating system tool
- To provide clear understanding about the role of firmware, operating systems in correlation with hardware systems.

Course Outcomes:

CO 1: Acquire a basic knowledge about fundamentals of microcontroller and knowledge about programming and system control to perform a specific task.

CO 2: Acquire knowledge about devices and buses used in embedded networking, and develop programming skills in embedded systems for various applications.

CO 3: Understand the concepts of memory interface, onboard external communication interfaces and design Procedure for Embedded Firmware.

CO 4: Expected to visualize the role of Real time Operating Systems in Embedded Systems.

CO 5: Expected to evaluate the Correlation between task synchronization and latency issue.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of

Embedded Systems. Typical Embedded System - Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS).

UNIT -II: Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT – III: Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV: RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multi-processing and Multitasking, Task Scheduling.

UNIT – V: Task Communication: Shared Memory, Message Passing, Remote Procedure Calland Sockets, Task Synchronization: Task Communication / Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Books:

1. Introduction to Embedded Systems-Shibu K.V, McGrawHill.

Reference Books:

1. Embedded Systems-RajKamal, MCGRAWHILLEDUCATION.
2. Embedded System Design-Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems–Lyla, Pearson, 2013
4. An Embedded Software Primer- David E. Simon, Pearson Education.

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INFORMATION THEORY AND CODING (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Information Theory and Coding	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To provide an insight into the concept of information in the context of communication theory and its significance in the design of communication receivers.
- To explore in detail, the calculations of channel capacity to support error-free transmission and also, the most commonly used source coding and channel coding algorithms.
- Introduction to error-correcting codes. Types of error correcting codes and its applications
- To encourage and train to design coding schemes for data compression and error correction.

Course Outcomes:

CO 1: Overview of Probability Theory, significance of "Information" with respect to Information Theory. Derive equations for entropy, mutual information and channel capacity for all kinds of channels.

CO 2: Implement the various types of source coding algorithms and analyse their performance.

CO 3: Explain various methods of generating and detecting different types of error correcting codes.

CO 4: Understand the fundamentals of Field Theory and polynomial arithmetic, and design linear block codes and cyclic codes (encoding and decoding).

CO 5: Implement and decode a sequence at the receiver using Trellis decoder and Viterbi decoder.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT – I: Information Theory: Information measure, Entropy and Information rate, Coding for a discrete memory less source, Predictive coding for sources with memory, Information transmission on discrete channels, Mutual information.

UNIT – II: Information Channels: Discrete channel capacity, coding for the binary symmetric channel, Continuous channels and system comparisons, continuous information, continuous

channel capacity, Ideal communication system, system comparisons.

UNIT – III: Error Controlling Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array.

UNIT – IV: Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction

UNIT – V: Convolution Coding: Practical Convolution Encoder, Time Domain Approach, Transform Domain Approach, The Code Tree, Code Trellis, State Diagram, Decoding Methods of Convolution Codes, Sequential Decoding, Burst Error Detection and Correction Codes, Concatenated Block Codes, Turbo Codes.

Text Books:

1) Communication Systems,3/e, by A.B. Carlson, Mc. Graw Hill Publishers (for topic1)
2) Digital Communications by Simon Haykin, John Wiley & Sons (for topic 2).
3) Principles of Digital Communication, J. Das, S.K.Mullick, P. K. Chatterjee, Wiley, 1986-Technology &Engineering.
4) Information Theory and Coding, HariBhat, Ganesh Rao, Cengage, 2017.

Reference Books:

1) Principles of Digital Communications, Signal representation, Detection, Estimation &Information Coding by J Das, S.K. Mullick, P.K.Chatterjee, New Age Int. Ltd.
2) Principles of Communication Systems, Taub &Schilling, 2/e, TMH Publisher.

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ARTIFICIAL NEURAL NETWORKS (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Artificial Neural Networks	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To provide an insight into the basic concepts.
- To understand the artificial intelligence as representation and search and its applications representation and inference.
- Situations and machine learning.
- Convolution Neural networks and Recursive Neural networks.
- Different neural and synaptic dynamics.

Course Outcomes:

CO 1: Understand the concepts Neural Networks based on learning methods.

CO 2: Apply knowledge on Rosenblatt's perceptron.

CO 3: Understand radical basis function networks and Hopfield networks.

CO 4: Analyze CNN and recursive neural networks.

CO 5: Evaluate the concepts of Reinforcement learning.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Introduction to Neural Networks: Architecture based classification of Neural Networks. Classification of Neural Networks based on learning methods. Activation functions and Loss functions. Factors to be considered for choice of type of Neural Network. Introduction to hardware requirements for implementation of Neural Networks.

UNIT – II: Rosenblatt's perceptron model: Rosenblatt's perceptron convergence theorem. Back Propagation Method. Back propagation learning algorithm for multilayer feed forward Neural Network. Factors affecting back propagation-based training of a Neural Network.

UNIT – III: Radial basis function networks: Generalized regularization theory. Neural Network models with Hebbian learning. Introduction to Hopfield networks. Recurrent Neural Network

models. Universal approximation theorem. Backpropagation through time. Real time recurrent learning. Long short-term memory.

UNIT -IV: Convolutional Neural Networks: Variants of the basic convolution function. Convolution algorithms. Recursive Neural Networks. Greedy layer-wise pretraining. Transfer learning. Structured probabilistic models for deep learning. Convolutional Boltzmann machines.

UNIT -V: Model based calculation of reward in Reinforcement learning: Markov decision process. Bellman's optimality criteria. Policy iteration. Value iteration. Q-learning. Model free Reinforcement learning. Deep reinforcement learning. Generative adversarial networks.

Text Books:

1. S. O. Haykin. Neural Networks & Learning Machines. 3rd Ed. Pearson. 2019

Reference Books:

1. S. J. Russell and P. Norvig. Artificial Intelligence: A Modern Approach. 3rd Ed. Pearson. 2016.

2. Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2018.

3. I. Goodfellow, Y. Bengio, A. Courville, F. Bach. Deep Learning (Adaptive Computation and Machine Learning series). MIT Press. 2016

4. S. O. Haykin. Neural Networks: A comprehensive foundation. 2nd Ed. Pearson. 1997

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DATA SCIENCE (OE)

Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Data Science	**4**			**30**	**70**	**100**	**3hrs**	**3**

COURSE OBJECTIVES: From the course the student will learn

- Knowledge and expertise to become a data scientist.
- Essential concepts of statistics and machine learning that are vital for data science;
- Significance of exploratory data analysis (EDA) in data science.
- Critically evaluate data visualizations presented on the dashboards.
- Suitability and limitations of tools and techniques related to data science process.

COURSE OUTCOMES: At the end of the course, student will be able to

CO 1: Analyze the fundamental concepts of data science, distinguish between various data science methods, algorithms and models used in business applications.

CO 2: Describe the steps involved in Data Science process and the technologies needed for a data scientist.

CO 3: Identify suitable ML techniques for data modeling and apply them for decision support and handle large datasets with distributed storage and processing system.

CO 4: Gives the concepts of appropriate tools for data collection, EDA and model building for specific types of data, Integrate functions, modules and packages to develop algorithms using built-in libraries and frameworks.

CO 5: Design and create eco-friendly applications using object-oriented programming concepts, and allows building a prototype application of Data Science as a case study.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT I: Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science. Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them.

Unit II: Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning.Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems.

UNIT III: NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling.

UNIT IV: Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts.

UNIT V: Data Visualization and Prototype Application Development: Data Visualization options, crossfilter, the JavaScript Map Reduce library, creating an interactive dashboard with dc.js, Dashboard development tools, applying the DS process for respective engineering problem solving scenarios as a detailed case study.

Textbook:

1) Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dreamtech press, 2016.

2) Prateek Gupta, "Data Science with Jupyter" BPB publishers, 2019 for basics.

Reference Books:

1) Joel Grus, "Data Science from Scratch", OReilly, 2019.

2)Doing Data Science: Straight Talk from The Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013.

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (OE)

Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Artificial Intelligence and Machine Learning	**4**			**30**	**70**	**100**	**3hrs**	**3**

COURSE OBJECTIVES: From the course the student will learn

- Know user interfaces to improve human and AI interaction and decision making.
- Allows the students to develop AI skills.
- Introduce the concepts of expert systems and machine learning.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.

COURSE OUTCOMES: At the end of the course, student will be able to

CO 1: Understanding Artificial Intelligence and different branches of Artificial Intelligence and demonstrate awareness of informed search and exploration methods.

CO 2: Understanding various Machine Learning Methods.

CO 3: Analyzing the different Classification and Regression Techniques.

CO 4: Familiarization of Architecture in Convolution Neural Networks.

CO 5: Understanding the concepts of different supervised learning methods and its Applications.

Syllabus

Unit I: Introduction to Artificial Intelligence: Biological Motivation for a Human Brain, Neural Network Representation, ANN Architecture, Perceptron, Multi-Layer Perceptron Structure, Back Propagation.

Unit II: Machine Learning: Introduction to Machine Learning, Different Types of Machine Learning Methods, Supervised, Semi Supervised, Unsupervised and Reinforcement Learning.

Unit III: Classification and Regression Algorithms: Difference Between Classification and Regression, Classification Algorithms, KNN, SVM Algorithms and its Applications, Regression Algorithm, Linear Regression, Decision Tree Regression and Random Forest Regression.

Unit IV: Convolution Neural Networks: Introduction to Convolution Neural Networks**,** Basic Principle, Architecture**,** Types of CNN Layers, Pooling Layers, Convolution Layers and Fully Connected Layers, Applications of CNN.

Unit V: Advanced Topics in Artificial Intelligence and Machine Learning: DNN Model, Significance, Overview of DNN Technique and its Applications, Generative Models, Working Principle of GAN and its Applications.

Text Books:

1. Artificial Intelligence and Machine Learning by Vinod Chandra SS and Anand Hareendran S, PHI Publications.
2. Artificial Intelligence – A Model Approaceh Stuart Russel and Peter Norvig.

Reference Books:

1. Introduction to Artificial Intelligence by Ertel W (2018) Springer International Publishing.
2. Machine Learning and Artificial Intelligence by Joshi and Ameet V (2022) Springer International Publishing.

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ANNEXURE – III

HSS ELECTIVES

1. Industrial Management & Entrepreneurship.
2. Organizational Behavior.
3. Operations Research.
4. Financial Management for Engineers.

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP (HSSE)

Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Industrial Management and Entrepreneurship	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives :

- To familiarize the students with the concepts of Management.
- To relate the concepts of Management with industrial organizations.
- To explain the factors affecting productivity and how productivity can be increased in an Industrial undertaking.
- To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

CO 1: Understand the roles, skills and functions of management and distinguish the different types of business organizations.

CO 2: Identify the factors involved in Production Operations Management.

CO 3: Diagnose organizational problems and take suitable decisions.

CO 4: Establish good Human Resource Management practices.

CO 5: Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I: Basic Concepts of Management: Management: Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management.

UNIT – II: Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

UNIT -III: Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

UNIT – IV: Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

UNIT – V: Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques, Stages in Project formulation; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Text Books:

1. Sharma, S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.
2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

Reference Books:

1. Aryasri, A.R., Management Science, McGraw Hill Education (India Private Limited New Delhi 2014.
2. Sheela, P. and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

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ORGANIZATIONAL BEHAVIOR (HSSE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Organizational Behavior	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives :

- To understand the basic concepts of organizational behaviour, its foundations and importance.
- To enable students to have a basic perspective of Motivation and Motivation theories.
- To acquaint the students about group behavior in organizations, including communication, leadership conflicts and organizational change and how these are linked to, and impact organizational performance.

Course Outcomes:

CO 1: Identifying fundamental aspects of organizational dynamics.

CO 2: Evaluate main theories of motivation and formulating suitable motivational strategies.

CO 3: Analyze the behavior of individuals and groups in organizations.

CO 4: Understanding of Leadership theories and Leadership behavior.

CO 5: Apply relevant theories, concepts to address important Organizational Behavior questions.

SYLLABUS
(with effect from 2022-23 admitted Batch)

UNIT – I : Organizational Beaviour : Concept of Organisation- Concept of Organisational Behaviour - Nature of Organisational Beaviour - Role of Organisational Beaviour - Disciplines contributing to Organisational Beaviour.

UNIT – II : Motivation : Definition - Nature of Motivation - Role of Motivation - Theories of Motivation :Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and Mc Gregor's Theory X and Theory Y.

UNIT - III: Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness. Leadership -Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

UNIT – IV : Communication : Manning - Communication Process - Forms of communication : Oral, Written and Non- Verbal communication - Direction of communication : Downward, Upward and Horizontal communication.

UNIT – V : Organisational conflicts : Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Inter organisational conflict - Conflict management. Organisational Change -Nature - Factors in Organisational change -Planned change : Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Text Books.

1. L.M.Prasad: Organisational Beaviour, Sultan Chand & Sons, New Delhi -110002.
2. K. Aswathappa: Organisational Behaviour, Himalaya Publishing House, New Delhi

Reference Books.

1. Stephen Robbins: Organizational Behaviour, Pearsons Education, New Delhi.

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OPERATIONS RESEARCH (HSSE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Operations Research	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- Formulate a real-world problem as a mathematical programming model.
- Provide knowledge of optimization techniques and approaches.
- Understand and study inventory problems.
- Know the network models.
- Put on knowledge in solving replacement problems and different queueing models.

Course Outcomes:

CO 1: Learned to translate a real-world problem into a mathematical formulation.

CO 2: Convert the problem into a mathematical model.

CO 3: Formulate and Solve Transportation, Assignment and sequencing problems.

CO 4: Able to solve maximum flow and shortest path problems.

CO 5: Capable to solve replacement problems and analyze inventory models.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT - I: Introduction to Optimization: Engineering Applications of Optimization, Statement of Problem, Classification of Optimization Problem Techniques.

UNIT – II: Linear Programming: Introduction, Requirements for a LP Problem, Examples on The Application of LP, Graphical Solution of 2-Variable LP Problems, Some Exceptional Cases, General Mathematical Formulation For LPP, Canonical and Standard Forms of LP Problem, Simplex Method, Examples on The Application of Simplex Techniques. Artificial Variable Techniques - Big-M Method and Two-Phase Techniques.

UNIT – III: Transportation Problem: Matrix Terminology, Definition and Mathematical Representation of Transportation Model, Formulation and Solution of Transportation Models

(Basic Feasible Solution by North-West Corner Method, Inspection Method. Vogell's Approximation Method). Assignment Problem - Matrix Terminology, Definition of Assignment Model, Comparison with Transportation Model, Mathematical Representation of Assignment Model, Formulation and Solution of Assignment Models.

UNIT – IV: Pert Network Introduction, Phases of Project Scheduling, Network Logic, Numbering the Events (Fulkerson's Rule), Measure of Activity. Pert Network Computations-Forward Pass and Backward Pass Computations, Slack Critical Path, and Probability of Meeting the Scheduled Dates.

UNIT – V: Inventory Models: Introduction, Necessity for Maintaining Inventory, Classification of Inventory Models, Inventory Models with Deterministic Demand, Demand Rate Uniform Production Rate Infinite, Demand Rate Non-Uniform Production Rate Finite, Demand Rate Uniform-Production Rate Finite. Game Theory: Useful Terminology, Rules for Game Theory, Saddle Point, Pure Strategy, Reduce Game by Dominance, Mixed Strategies, 2x2 Games Without Saddle Point.

Text Books:

1. "Operations Research-An Introduction' By H. Taha, Prentice Hall of India Pvt. Ltd.

2. "Engineering Optimization-Theory & Practice" By S.S. Rao, New Age International (P) Ltd.

Reference Books:

1."Operations Research – An Introduction" By P. K. Gupta& D. S. Hira, S. Chand & Co. Ltd

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FINANCIAL MANAGEMENT FOR ENGINEERS (HSSE)

Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Int.	Ext.			
	Financial Management for Engineers	**4**			**30**	**70**	**100**	**3hrs**	**3**

Objectives of this Course:

- To provide awareness and understanding of the ways finance helps in reaching business objectives.
- To familiarize with the form, content and analysis of financial statements and the accounting principles and techniques.
- To Identify signals pointing to deterioration in financial condition and analyze the reasons for variances between the actual and budgeted results
- To facilitate in the improvement of organizations' performance by pointing out the importance of cost control, breakeven and variance analysis.
- To equip with the ability to communicate comfortably with Financial Executives and discuss the financial performance of the organization effectively.

Outcomes of the Course:

CO 1: Ability to analyze financial statements.

CO 2: Understanding costs and methods to reduce them.

CO 3: Taking decisions regarding the price of the products services, or both.

CO 4: Understanding of capital budgeting and various capital budgeting techniques.

CO 5: Skill to practice different Budgeting Systems in organizations.

SYLLABUS

(with effect from 2022-23 admitted Batch)

UNIT-I: Accounting concepts and systems - Elements of Financial Statements - trading, profit & loss Statement- Cash Flow Statements - Notes to Accounts - Profits vs. Cash Flows.

UNIT-II: Analysis of Financial Statements - Financial Analysis-Financial Ratios and their Interpretations covering: Profitability Ratios; Liquidity Ratios; Return on Capital Ratios; - Management of Working Capital: Capital and Its Components - Working Capital Cycle - Working Capital Financing.

UNIT-III: Management Decision Making: Cost concepts and its application in Decision Making - Types of cost – Direct& Indirect, Fixed& Variable - Cost Sheet - Cost Volume Profit Analysis - Understanding Cost behavior – Cost concepts and its application in Decision Making - Relevance of Activity Based Costing - Marginal Costing - Make or Buy - Shut down or continue - Sell or process further - Domestic vs. Export Sales.

UNIT-IV: Budgets and Budgetary Control: Different types of Budgets (Departmental, Function based, Cash, Master) - Budgeting systems (ABC / ZBB / Rolling/ Incremental / Planning) - Variance Analysis - Capital Budgeting and Investment Appraisals - Meaning of Capital Budgeting - Relevance of Capital Budgeting - Techniques of Capital Budgeting - Payback Period - Accounting Rate of Return - Net Present Value - Internal Rate of Return - Discounted Payback Period.

UNIT-V: Means of Finance: Financial Instruments - Shares, Debentures, Derivatives - Share Capital Vs. Term Loans - Leasing - Financial Markets - Capital Markets - Stock Exchanges**.**

Suggested Books:

1. Finance for Non-Finance People by Sandeep Goal (2017), Publisher: Taylor and Francis.
2. Finance for Non-Finance Managers by B.K. Chatterjee (1988), Jaico Publishing House, Sold by Amazon.
3. Finance for Nonfinancial Managers: Finance for Small Business, Basic Finance Concepts (Accounts and Finance) by Murugesan Ramaswamy (2021), Repro Books-On-Demand.

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Dept. of Electronics & Communications Engineering

Andhra University College of Engineering

Visakhapatnam-530003

4 Years B.TECH
Programme Code: 3-1-12

and

B.TECH+M.TECH (DOUBLE DEGREE COURSE)
Programme Code: 3-5-07

Scheme of Instruction and Examination with effect from 2022-2023 admitted batch onwards

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
A U COLLEGE OF ENGINEERING
ANDHRA UNIVERSITY
SCHEME AND SYLLABI
(with effect from 2022-23 admitted Batch)

B.Tech & B.Tech+M.Tech
I Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC1101	BS	Mathematics – I	4	0	30	70	100	3
EC1102	BS	Physics	4	0	30	70	100	3
EC1103	ES	Digital Logic Design	4	0	30	70	100	3
EC1104	ES	Electronic Devices and Circuits	4	0	30	70	100	3
EC1105	ES	Network Theory and Machines	4	0	30	70	100	3
EC1106	ES	Digital Logic Design Lab	0	3	50	50	100	1.5
EC1107	BS	Physics Lab	0	3	50	50	100	1.5
EC1108	ES	Electronic Devices and Circuits Lab	0	3	50	50	100	1.5
							Total Credits	**19.5**

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B.Tech & B.Tech+M.Tech
I Year - II Semester
(with effect from 2022-23 admitted Batch)

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC1201	BS	Mathematics – II	4	0	30	70	100	3
EC1202	BS	Green Chemistry	4	0	30	70	100	3
EC1203	HSS	English	4	0	30	70	100	3
EC1204	ES	Computer Programming and Numerical Methods	4	0	30	70	100	3
EC1205	ES	Electronic Circuit Analysis	4	0	30	70	100	3
EC1206	HSS	English Language Lab	0	3	50	50	100	1.5
EC1207	BS/ES	Electronic Circuit Analysis Lab	0	3	50	50	100	1.5
EC1208	ES	Computer Programming and Numerical Methods Lab	0	3	50	50	100	1.5
							Total Credits	**19.5**

B.Tech & B.Tech+M.Tech
II Year - I Semester
(with effect from 2022-23 admitted Batch)

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC2101	BS	Mathematics -III	4	0	30	70	100	3
EC2102	PC	Python Programming	4	0	30	70	100	3
EC2103	PC	Analog Communications	4	0	30	70	100	3
EC2104	PC	Signals & Systems	4	0	30	70	100	3
EC2105	HSS	Managerial Economics	4	0	30	70	100	3
EC2106	PC	Python Programming Lab	0	3	50	50	100	1.5
EC2107	PC	Analog Communications Lab	0	3	50	50	100	1.5
EC2108	PC	Signals & Systems Simulation Lab	0	3	50	50	100	1.5
EC2109	SC	Digital Circuit Simulation	1	2	50	50	100	2
EC2110	MC	Professional Ethics and Universal Human Values	0	0	00	100	100	0
EC2111	MC	NCC/NSS	0	2	-	-	-	0
							Total Credits	**21.5**

B.Tech & B.Tech+M.Tech
II Year - II Semester
(with effect from 2022-23 admitted Batch)

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC2201	ES	Probability theory and Random Process	4	0	30	70	100	3
EC2202	PC	Electromagnetic Field Theory and Transmission Lines	4	0	30	70	100	3
EC2203	PC	Microprocessors and Microcontrollers	4	0	30	70	100	3
EC2204	PC	Linear ICs & Applications	4	0	30	70	100	3
EC2205	PC	Pulse and Digital Circuits	4	0	30	70	100	3
EC2206	PC	Microprocessors & Microcontrollers Lab	0	3	50	50	100	1.5
EC2207	PC	Linear ICs & Pulse Circuits Lab	0	3	50	50	100	1.5
EC2208	SC	Electronic Circuit Simulation	1	2	50	50	100	2
EC2209	MC	Environmental Science	0	0	00	100	100	0
							Total Credits	**20**
Internship-I(2 months duration)								

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Guidelines for Obtaining MINORS in Electronics and Communication Engineering:

To obtain a MINOR degree in Electronics and Communication Engineering, students from different departments must complete certain compulsory courses and elective courses as specified below:

For Students from CSE & IT Departments:

- **Compulsory Courses:**
  1. Digital Logic Design
  2. Microprocessors
- **Electives:** Choose any two from the following six open electives offered by the ECE department.

For Students from EEE Departments:

- **Compulsory Courses:**
  1. Signals and Systems
  2. EMF Theory
- **Electives:** Choose any two from the following six open electives offered by the ECE department.

For Students from Instrument Technology Departments:

- **Compulsory Courses:**
  1. Electronic Devices and Circuits
  2. Signals and Systems
- **Electives:** Choose any two from the following six open electives offered by the ECE department.

For Students Who Have Not Completed Any Compulsory Courses:

- **Electives:** Choose any four from the following six open electives offered by the ECE department.

List of Six Open Electives Offered by the ECE Department:

1. GPS Principles and its Applications
2. Mobile Cellular Communication
3. Embedded System Design
4. Information Theory and Coding
5. Wireless Sensor Networks
6. Artificial Neural Networks

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Guidelines to Obtain MINORS in Other Branches of Engineering for Electronics and Communication Engineering Students:

Electronics and Communication Engineering students to Obtain MINOR degree from other branches of engineering, students from ECE department must complete certain compulsory courses and elective courses as specified below:

- Choose any four courses from the following open electives offered by the other departments.

List of Subjects offered from different departments to obtain MINOR(s) in the respective discipline				
S.No	**CSE**	**EEE**	**Instrument Technology**	**Mechanical Engineering**
1.	CPNM (C)	Network Theory (C)	Transducers and Measurements	Engineering Mechanics and Strength of Materials
2.	Python Programming (C)	Control Systems	Electrical and Electronic Instrumentation	Basics of Theory of Machines
3.	Artificial Intelligence and Machine Learning	Renewable Energy Sources	Industrial Instrumentation and Process Control	Fundamentals of Engineering Design
4.	Data Science	Energy Management and Auditing	Embedded Systems and Design	Production Technology
5.	Cyber Security and Digital Forensics	Electrical Wiring	Biomedical Instrumentation	Basic Thermal Engineering
6.	DBMS	Electrical GIS	Sensors and Signal Conditioning	Concepts of Industrial Engineering
7.		Renewable Energy Sources	MEMS	
8.			Electronic Devices and Circuits	

* C- Compulsory

(Note: The specific electives offered may vary; please refer to the current curriculum for the exact list of electives available.)

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- The MOOC(s) chosen by students from other departments for obtaining a MINOR degree in ECE should have prior permission/approval from the Head of the Department and Chairman BoS of the Department of Electronics and Communication Engineering, AUCE (A).

- The duration of NPETL courses should NOT be less than 12 weeks.

Guidelines for Obtaining Honors in Electronics and Communication Engineering

The student shall earn additional 15 credits beyond 160 credits from same branch/department/discipline registered for Honor degree.

i. The students having 7.0 CGPA without any backlog subjects will be permitted to register for Honors.

ii. If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

iii. Honor is to be completed simultaneously with B.Tech programme.

The ECE department offers Honors in VLSI Stream. To obtain Honors in VLSI Stream the following subjects are to be taken:

1. Analog IC Design.
2. CPLD and FPGA Architectures and Applications.
3. Digital System Design.
4. Algorithms for VLSI Design Automation.
5. System Modelling and Simulation.
6. Application Specific Integrated Circuit (ASIC)
7. RF& Microwave Integrate Circuits.

- MOOCs for 3 credits of 12 weeks duration related to any one of the above courses. MOOCs may be treated as optional to obtain HONORS degree in ECE. If a student completes MOOCs with good grade, then it may be considered as betterment for any of the above seven courses (1 to 7).
- The above seven courses and MOOCs may be completed or pursued during 3rd and 4th years of his/her study of B.Tech program.

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B SCHEME and Syllabus
(With effect from 2022-23 admitted Batch)
B.Tech & B.Tech+M.Tech
III Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC3101	PC	Control Systems	4	0	30	70	100	3
EC3102	PC	Digital Communications	4	0	30	70	100	3
EC3103	PC	Internet of Things	4	0	30	70	100	3
EC3104	PE	Professional Elective-I	4	0	30	70	100	3
EC3105	OE	Open Elective-I	4	0	30	70	100	3
EC3106	PC	Digital Communication Lab	0	3	50	50	100	1.5
EC3107	PC	Internet of ThingsLab	0	3	50	50	100	1.5
EC3108	SC	Object Oriented Programming through JAVA	1	2	50	50	100	2
EC3109	INT	Internship-I			50	50	100	2
Internship-I(2months) done after 2nd Year 2nd Semester to be evaluated during 3rd Year 1st Semester								
							Total Credits	**22**

B.Tech & B.Tech+M.Tech
III Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC3201	PC	Antennas and Wave Propagation	4	0	30	70	100	3
EC3202	PC	Digital Signal Processing	4	0	30	70	100	3
EC3203	PC	Microwave Engineering	4	0	30	70	100	3
EC3204	PE	Professional Elective-II	4	0	30	70	100	3
EC3205	OE	Open Elective-II	4	0	30	70	100	3
EC3206	PC	Antenna Simulation Lab	0	3	50	50	100	1.5
EC3207	PC	Digital Signal Processing Lab	0	3	50	50	100	1.5
EC3208	PC	Microwave Engineering Lab	0	3	50	50	100	1.5
EC3209	SC	Soft Skills	1	2	50	50	100	2
							Total Credits	**21.5**
Internship-II (2 months duration)								

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B.Tech & B.Tech+M.Tech
IV Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC4101	PE	Professional Elective-III	4	0	30	70	100	3
EC4102	PE	Professional Elective-IV	4	0	30	70	100	3
EC4103	PE	Professional Elective-V	4	0	30	70	100	3
EC4104	OE	Open Elective-III	4	0	30	70	100	3
EC4105	OE	Open Elective-IV	4	0	30	70	100	3
EC4106	HSSE	HSS-Elective	4	0	30	70	100	3
EC4107	SC	WEB Technologies	1	2	50	50	100	2
EC4108	INT	Internship-II			50	50	100	2
Internship-II (2months) done after 3rdYear 2nd Semester to be evaluated during 4th Year 1st Semester								
							Total Credits	**22**

B. Tech & B. Tech+M.Tech
IV Year - II Semester

Course code	Category	Course Title	Internal Marks	External Marks	Total Marks	Credits
EC4201	PROJ	Project work	100	100	200	14
					Total Credits	**14**

Note: **It is mandatory to complete one MOOCS Course (12 weeks or more duration) related to ECE for obtain B.Tech Degree in ECE. This can be added in Lieu of any other courses.**

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PROFESSIONAL ELECTIVES (PE)

1. Global Positioning System.
2. Radar Engineering.
3. Cellular Mobile Communication.
4. Electronic Measurements and Instrumentation.
5. Data Structures.
6. EMI/EMC.
7. Internet and Web Technology.
8. Speech Processing.
9. Computer Networks.
10. TV and Satellite Communication System.
11. Transducers and Signal Conditioning.
12. VLSI Design.
13. Digital Image Processing.
14. Smart Antenna Systems.
15. Advanced Microprocessors.

OPEN ELECTIVES (OE)

1. Low Power VLSI Design.
2. Wireless Sensor Networks.
3. Bio-Medical Instrumentation.
4. FPGA Design.
5. DSP Processors and Architectures.
6. Fiber Optic Communication.
7. GPS Principles and its Applications
8. Mobile Cellular Communication
9. Embedded System Design
10. Information Theory and Coding
11. Wireless Sensor Networks
12. Artificial Neural Networks
13. Data Science.
14. Artificial Intelligence and Machine Learning.

HSS ELECTIVES (HSSE)

1. Industrial Management & Entrepreneurship.
2. Organizational Behavior.
3. Operations Research.
4. Financial Management for Engineers.

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Guidelines for offering Honors:

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

ii) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).

iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.

iv) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.

v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.

viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.

x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

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Enrolment into Honors:

i. Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline

ii. The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular 16 Andhra Pradesh State Council of Higher Education (APSCHE) MODEL ENGINEERING

CURRICULUM - 2023 entry students and only III semester in case of lateral entry students. Students having 7.0 CGPA without any backlog subjects will be permitted to register for Honors.

iii. If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

iv. Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

v. Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

i. The eligible and interested students shall apply through the Head of the Department (HOD) of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

ii. The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.

iii. The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

iv. There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

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