With effect from the academic year 2023-24

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instruction as per R20 Curriculum

B.E. (MECHANICAL ENGINEERING)

SEMESTER – VII

S. No.	Course Code	Title of the Course	Scheme of instruction			Scheme of Examination			Credits
			Hours per week			Duration in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1		Professional Elective - IV	3	--	--	3	40	60	3
2		Professional Elective - V	3	--	--	3	40	60	3
3		Open Elective - II	3	--	--	3	40	60	3
4		Open Elective – III	3	--	--	3	40	60	3
5	20EGM04	Gender Sensitization	2	--	--	2	--	50	*Non Credit
6	20MBC01	Engineering Economics and Accountancy	3	--	--	3	40	60	3
PRACTICALS									
7	20MEC33	Project Part-1	--	--	4	--	50	--	2
		Internship	4-6 Weeks/ 180 hours						3
TOTAL			**17**	**--**	**04**	**--**	**250**	**350**	**17+3**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE – Semester End Examination

Professional Elective – IV (3/3)			**Professional Elective – V (3/3)**		
S.No.	**Subject Code**	**Name of the Subject**	**S. No.**	**Subject Code**	**Name of the Subject**
1	20MEE13	Automobile Engineering	1	20ME E17	Renewable Energy Sources
2	20MEE14	Control System Theory	2	20ME E18	Digital Manufacturing and Industry 4.0
3	20MEE15	Mechanical Vibrations	3	20ME E19	Composite Materials and Testing
4	20MEE16	Supply Chain Management	4	20ME E20	Block Chain Technology

Open Elective-II (3/3)		
S. No.	**Subject Code**	**Name of the Subject**
1	20CSO05	Basics of Artificial Intelligence
2	20CH O06	Fundamentals of Fuel Cells
3	20CEO02	Disaster and Risk Reduction Management
4	20ECO05	System Automation and Control
5	20EGO01	Technical Writing Skills

Open Elective-III (3/3)		
S. No.	**Subject Code**	**Name of the Subject**
1	20ITO02	Principles of Internet of Things
2	20CSO02	Introduction to Web Technology
3	20ECO04	Principles of Embedded Systems
4	20PYO01	History of Science and Technology
5	20ADO01	Introduction to Python Programming

With effect from the academic year 2023-24

20MEE13

AUTOMOBILE ENGINEERING

(Professional Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Objectives:

1. To learn about the layout and arrangement of principal parts of an automobile.
2. To understand working of different types of Drive train and Transmission Systems
3. To learn about different types of Steering, Axle, Wheels and Tyres.
4. To understand different types of Suspension and braking systems.
5. To learn about Alternative Energy Sources for Automobiles.

Outcomes: Student will be able to:

1. Identify principal parts of an automobile and its layout.
2. Understand the various systems in automobile like engine cooling, lubrication, ignition, electrical and air conditioning systems with the principles of thermodynamics.
3. Understand the various suspension and steering systems.
4. Analyse the functioning of drive train, transmission and braking systems.
5. Understand the importance of alternative power trains for pollution control.

UNIT - I

Engine: Engine location and its components, chassis layout - parts of the automobile body, terminology, automobile frames ; crank shaft, firing order, piston and piston rings, cylinder liners, valves and operation mechanism, VVT , Carburetion, GDI Engines, MPFI, Compression Ignition engines - Fuel Injection System and Electronic Fuel Injection system

Maintenance: Trouble shooting and overhauling, engine tune up

UNIT - II

Lubricating Systems: Wet sump, dry sump and petroil systems

Cooling systems: Water pumps, radiators, thermostat control, anti-freezing compounds

Ignition Systems: Ignition Systems – Battery, Magneto and Electronic Ignition Systems.

Electrical Systems : Main electrical circuits, Batteries and charging systems, Starting circuit, lighting system, indicating devices, warning lights, speedometer, automobile air-conditioning

UNIT - III

Wheel and tyres: Tyre construction, specification, Tyre wear and causes.

Suspension systems: Types of Suspension systems, Independent suspension, coil and leaf springs, torsion bar, shock absorbers

Steering Systems: Linkage arrangements and its components, steering gear box types, Electronic power steering system, Davis & Ackerman Steering, Steering geometry: caster, camber, King Pin Inclination, Toe in, toe out, wheel balancing, wheel alignment

UNIT – IV

Power Train: Clutches – Single plate & Multiplate clutches, Gearbox – Manual, and automatic gearboxes. Torque converter, propeller shaft, universal coupling, differential, four-wheel drive system

Brakes Systems: Disc and Drum Brakes, Description and operation of hydraulic brake, hand brake linkage, ABS, EBD

UNIT – V

Pollution control: Pollution control techniques used for petrol and diesel engines, PCVS, EGR, SCRT, Thermal Reactors, Catalytic converters; Euro norms and Bharat Norms.

Alternative Power Trains: Electric Vehicles, Hybrid Vehicles, Batteries used in Electric and Hybrid Vehicles, Battery charging systems. Fuel cell Vehicles – Introduction

Text Books:

1. R. K. Rajput, A Textbook of Automobile Engineering, 2nd edition, Laxmi Publications Pvt Ltd, 2007
2. Kirpal Singh, Automobile Engineering, Vol I and II",12th edition, Standard Publishers, 2011
3. P.L. Kohli, Automotive Electrical Equipment, Tata McGraw Hill, 1985.

Suggested Reading:

1. S. Srinivasan, Automotive Mechanics, 2nd edition, Tata Mc Graw Hill, 2003
2. William H. Crouse, Donald L. Anglin, "Automotive Mechanics", 10th edition, Tata Mc Graw Hill, 2007.

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20MEE14

CONTROL SYSTEMS THEORY

(Professional Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Objectives: Student will learn the

1. To provide with basic knowledge of control systems, associated terminologies, transfer function.
2. Familiar with basic electrical, mechanical & electromechanical system and their representation in Differential Equation / Transfer function form.
3. To make students familiar with system performance analysis in time & frequency domain.
4. To understand different methods of stability analysis
5. To provide basic pathway to space representation and controllability and observability

Outcomes: At the end of the course, the students are able to

1. Understand control system, modeling and transfer functions of different systems.
2. Apply the concept of block diagram and signal flow graphs to different systems.
3. Differentiate between time domain and frequency domain techniques.
4. Examine the stability of a system using different approaches.
5. Analyze the system in state space and to find out the controllability and observability.

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UNIT-I

Mathematical Modeling: Introduction to control systems , Open loop & closed loop systems, Mathematical modeling & Mechanical systems, Transfer functions from Governing equations, Electrical, hydraulic systems pneumatic, thermal systems, AC,DC servomotors &Electromechanical servo systems.

UNIT-II

Components of Control System: Introduction to Block diagrams & Problems, Signal flow graph & mason's gain formula, Transient response &time domain specifications of 1^{st} order systems, 2^{nd} order systems & time domain specifications, Steady state error, error coefficients, Sensitivity Performance Indices

UNIT-III

Time Domain Analysis: Routh criteria & root locus method, Frequency response, Bode & polar plots, Correlation between Transient & frequency response, Band width, Experimental determination of transfer function

UNIT-IV

Stability Analysis: Nyquist Criteria, Phase & gain margins, Lead, lag compensator design lead-lag compensator design, PID-controller, linearization of non linear systems

UNIT-V

State Space Representation: State space representation of linear control systems, State transition matrix, Solution of State Space Equations: Zero input response and Zero state response, Concept of controllability & observability

Text Books:

1. K. Ogata, Modern control Engineering, Prentice Hall, 2015.
2. M. Gopal., Control Systems, Tata McGraw Hill, 2012.
3. D. Roy Choudhury, "Control System Engineering", PHI, 2005

Suggested Reading:

1. Norman S.Nise., Control Systems Engineering, John Wiley & sons, Inc., 2018.
2. R.C. Dorf, Modern Control systems, 12^{th} edition Addison Wesley, 2011.

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20MEE15

MECHANICAL VIBRATIONS

(Professional Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Objectives:

1. To analyze free vibration, damped and undamped vibrations.
2. The principles of harmonically excited vibrations
3. The principle of damped and undamped vibrations of two degrees of freedom system
4. To develop the equations of motion for a continuous system in elongation, bending and torsion to find the natural frequencies and mode shapes.
5. The working principles of vibration measurements

Outcomes: At the end of the course, the students are able to

1. Apply Newton‘s law of motion and energy method to get governing differential equations of vibrating systems.
2. Analyze response of machine members in forced vibration with different excitation frequencies, Recommend suitable vibration parameters for isolation and compute critical speeds.
3. Analyze modeshape and decoupling of equation of motion for 2 degree of freedom systems.
4. Predict natural frequency and mode shape for all continuous systems.
5. Understand working principles of vibration measuring instruments.

UNIT - I

Introduction: Fundamentals of vibrations analysis, classification of vibrating systems, damping systems.
Single Degree of Freedom Systems: Formulation of equation of motion–Energy method, Rayleigh method, principle of virtual work, principal of conservation energy.
Free vibration response: Undamped, damped (viscously damped, logarithmic decrement, coulomb damping) translational & torsional systems, case studies on formulation and response calculation.

UNIT - II

Forced vibration response: Response of undamped systems to harmonic excitations, response of damped systems to harmonic excitations, response of damped systems to rotating unbalance, magnification factor, displacement transmissibility, force transmissibility, relative motion, vibration control–whirling of shafts.

UNIT - III

Two Degree of Freedom Systems: Free and forced vibration response–Formulation of equation of motion (undamped, damped), Eigen values and Eigen vectors, modal matrix, normal modes, modes superposition, coordinate coupling, principal coordinates, decoupling of equations of motion, influence coefficients, semidefinite systems, self-excitation and stability analysis.

UNIT - IV

Vibrations of Continuous Systems: Vibrations of strings, bars and beams, formulation of equations of motion, characteristic equations, identification of nodes and mode shapes.

UNIT - V

Vibration Measurements and Applications: Vibration pickup, vibrometer, accelerometer, Piezoelectric transducers, electrodynamic transducers;.
Vibration exciters–mechanical and electro dynamicshakers;
Frequency measuring instruments, Fault diagnosis of rotating machinery. Application in condition monitoring systems

Text Books:

1. J.J. Thomson, Theory of vibration with Application, 5th edition, 2014.
2. S.S. Rao, Mechanical vibration, 5th edition, Pearson, 2011
3. G.S. Grover & Nigam, Mechanical vibrations, 8th edition, New Chand & Bros**,** 2018

Suggested Reading:

1. V.P. Singh, Mechanical vibration, 3rd edition, Dhanpath Rai & Co., 2014.
2. S. Graham Kelley, Mechanical vibration, Schaums Outline Series, TMH, 2011.

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20MEE16

SUPPLY CHAIN MANAGEMENT

(Professional Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Objectives: Student will understand

1. The awareness about transportation and warehouse management systems.
2. The designing supply chain networks.
3. The concept of demand and supply and integrating it with supply chain management.
4. The planning and managing inventories.
5. The pricing and revenue management

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

1. Understand fundamentals of supply chain and its key concepts.
2. Design an effective supply chain network
3. Understand the essence of demand and supply and associated gaps
4. Apply inventory management techniques.
5. Evaluate pricing and revenue management systems.

UNIT-I

Concept of SCM:, Supply Chain definition, stages of supply chain, objectives, drivers of SCM-facilities, inventory, transportation, information, sourcing and pricing. Decision phases in Supply chain, pull and push processes, achieving strategic fit, expanding strategic scope. Introduction to Logistics Management.

UNIT-II

Designing the Supply Chain Network: Role of distribution in supply chain and factors influencing its network design and decisions.,Types of distribution networks – manufacturer storage with direct shipping, manufacturer storage with direct shipping and in transit merge, distributor storage with package carrier delivery, distributor storage with last mile delivery, manufacturer/distributor storage with customer pickup, retail storage with customer pick up. Framework for network design decisions-supply chain strategy, regional facility configuration, desirable sites and location choices, E-Business and Distribution network.

UNIT-III

Planning Supply and Demand: Planning demand & supply in a supply chain demand forecasting- moving averages, exponential smoothing, trend and seasonality, Risk management in forecasting. Aggregate planning, Master scheduling, Materials Requirement Planning, time phased order plan, critical ratio, product tree structures.

UNIT-IV

Planning & Managing Inventories in a Supply Chain: Inventory control, objectives of inventory management in supply chain, Deterministic inventory and probabilistic inventory control, Economic Order Quantity, quantity discounts, Reorder point. ABC analysis, FNSD analysis, VED analysis.

UNIT-V

Sourcing, Pricing, Coordination and IT in Supply chain : Sourcing decisions, key sourcing related processes, In-house or outsource, pricing & revenue management, differential pricing strategies, coordination in supply chain, bullwhip effect, information technology and supply chain, supply chain macro processes- CRM, ISCM, SRM, TMF

Text Books:

1. Sunil Chopra & Peter Meindl, Supply Chain Management – Strategy, Planning and Operation, Pearson Education, Inc., Upper Saddle River, New Jersey, 2003
2. N. J. Kumar &Mukesh Bhatia, Supply Chain Management, Neha publishers & Distributors, 2010.
3. Michael H. Hugos, Essentials of Supply Chain Management, 3rd edition, John Wiley & Sons, Inc, Hoboken, New Jersy, 2011.

Suggested Reading:

1. Martin Christopher, Logistics & Supply Chain Management, 5th edition, Financial Times Series, 2010.
2. Dobler Donald. W, David.N.Burt, Purchasing & supply Management Text & Cases, McGraw- Hill, 1996.
3. A.K. Chitale, R.C, Gupta, Materials Management-Text and Cases, Prentice-Hall Of India Pvt Limited, 2007.

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20MEE17

RENEWABLE ENERGY SOURCES

(Professional Elective-V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Objectives:

1. Need and importance of non-conventional energy resources
2. Extent of solar energy which can be utilized as energy resource
3. Concept of wind energy and its merits and demerits
4. Operating principles of geothermal energy and bio-energy
5. Merits and demerits of tidal energy, wave energy and OTEC

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

1. Recognise the importance of renewable energy and solar geometry.
2. Select the solar collector based on the application.
3. Understand the working principles of wind power plants.
4. Understand the principles of geothermal and biogas plants.
5. Distinguish wave, tidal and OTEC energy.

UNIT-I

Energy Sources: forms of energy, energy chain (route), Indian energy scenario, energy and environment, energy conservation and its importance, , classification of energy sources, classification of Renewable energy sources(RES), advantages and limitations of non renewable and renewable energy sources.

Solar Energy: Solar radiation, basic definitions: Irradiance, solar constant, insolation, radiosity, latitude, hour angle, declination, altitude angle, zenith angle, azimuth angle and radiation measuring instruments

UNIT-II

Solar thermal collectors: working, comparison, merits and demerits of flat plate and concentrating (focusing) collectors.

Applications of solar collectors: water heating, space heating, solar cookers, solar pond, solar thermal power plants based on central receiver, dish/stirling cycle and chimney, solar refrigeration.

Solar photovoltaics: materials, cells, space based solar power (SBSP), advantages and disadvantages. PV System applications stand alone and grid connected systems, various components of solar powered systems.

UNIT-III

Wind Energy: Sources of wind, merits and demerits of wind energy, site selection factors, classification of wind mills(turbines), working and comparison of horizontal axis, Savonius and Darries vertical axis windmills, power extracted from the wind, power duration and velocity duration characteristic curves, wind-solar and wind-diesel hybrid plants

UNIT-IV

Geothermal Energy: Layers in earth, resources of geothermal energy, hydrothermal, petrothermal and geopressure resources, advantages, disadvantages, applications and environmental effects of geothermal energy sources.

Biomass Energy: Resources, site selection factors, bio mass conversion processes: direct combustion, thermo chemical, bio chemical, working of KVIC, Janata, Deenbandu and Pragathi design(spherical) biogas plants, operational problems, causes and remedies relating to a biogas plant.

UNIT V

Tidal power: Tidal systems, site selection for tidal power plant, operation of single basin and double basin tidal plants, advantages and disadvantages of tidal power.

Wave energy - Differences between tides and waves, advantages and disadvantages of wave power, working principle of wave energy conversion devices.

Ocean thermal energy conversion (OTEC): OTEC power plants, location, open cycle and closed cycle OTEC plants, advantages, limitations and applications of OTEC, environmental impact of OTEC plants.

Text Books:

1. S. Hasan Sayeed and D.K. Sharma, Non Conventional Energy Resources, S.K. Kataria & Sons, New Delhi, 2017.
2. Dr. R.K. Singal, Non Conventional Energy Resources, S.K. Kataria & Sons, New Delhi, 2005.
3. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 2011.

Suggested Reading:

1. K. M. Mittal, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi, 2003.
2. R.K.Rajput, Non-Conventional Energy Sources and utilisation, S.Chand,2016.

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20MEE18

DIGITAL MANUFACTURING AND INDUSTRY 4.0

(Professional Elective-V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Objectives:

1. Understand the concept and applications of Digital Manufacturing and Industry 4.0.
2. Relate different Additive manufacturing processes as a part of Digital Manufacturing
3. Understand the concept of Virtual prototyping, digital design and Importance of reverse engineering in Digital Manufacturing
4. To understand the concept of Industry 4.0 and allied technologies.
5. To Provide an understanding on the challenges faced and relevant industrial applications of Industry 4.0

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

1. Understand the Basics and applications of Digital Manufacturing and Industry 4.0.
2. Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processes and their adaptability to Digital Manufacturing.
3. Understand the concepts of digital manufacturing based product life cycle and its management.
4. Understand the concept of Industry 4.0 and allied technologies.
5. Understand the basics of Internet of things and cloud computing pertaining the fourth industrial revolution.

UNIT-I

Introduction to digital manufacturing: Definition of digital manufacturing, Operation Mode and Architecture of Digital Manufacturing System, Impact on manufacturing careers, Advantages of digital manufacturing and design, Information sharing in the digital thread, Digital twins and Files format (STL, AMF, 3MF), Multiple organizations in the manufacturing process. Introduction of Industry 4.0, case study on car manufacturing by Bosch.

UNIT-II

Additive Manufacturing Processes: Additive Manufacturing processes – Engineering polymers, metals and ceramics. Stereolithography, Selective Laser Sintering, Fused Deposition Modeling, Layered object manufacturing. Electronic Materials, Bio-printing, Food Printing. Preprocessing and Post processing in AM

Virtual Prototyping & Reverse Engineering: Virtual Prototyping, Applications, Virtual Prototyping and Virtual Manufacturing. Reverse Engineering, Application of Reverse Engineering in Digital Manufacturing. Self-Learning of Manufacturing System and Intelligent Manufacturing System.

UNIT-III:

Key Technology of Digital Manufacturing: Various Digital Technologies in Product Lifecycle, Digital Equipment and Digital Processing Technology, Technology of Digital Maintenance and Diagnosis.

Product life cycle management: Introduction, Types of Product Data, Product life cycle management (PLM) systems. Features of PLM System, System architecture, Product information models, Functionality of the PLM Systems.

UNIT-IV:

Industry 4.0: Various Industrial Revolutions, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, automation, data exchanges, cloud, cyber-physical systems, mobile robots, Big Data, deep machine learning, Production Systems, IoT, Challenges of implementing Industry 4.0, Impact of implementing Industry 4.0 in various sectors, Applications domains and the way forward.

UNIT –V:

Internet of Things (IoT) - IoT design methods, physical devices and enabling technologies, Industrial Internet of Things (IIoT), Smart Manufacturing.

Cloud Computing and Manufacturing- Cloud models, cloud manufacturing examples, cloud based manufacturing, Cloud service and platforms for manufacturing.

Augmented Reality and Virtual Reality in Manufacturing.

Text Books:

1 Zude Zhou, Shane (Shengquan) Xie and Dejun Chen, Fundamentals of Digital Manufacturing Science, Springer-Verlag London Limited,2012

2 Brent Stucker, David Rosen, and Ian Gibson, Additive Manufacturing Technologies, ISBN 978-1-4419-1120-9, Springer, 2010

3 Chee Kai Chua, Kah Fai Leong, 3D printing and additive manufacturing: principles and Application, 4th edition of rapid prototyping

4 Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things.

Suggested reading:

1 Lihui Wang and Andrew Yeh Ching Nee, Collaborative Design and Planning for Digital Manufacturing, Springer-Verlag London Limited, 2009

2 Venuvinod, PK; Ma, W; Rapid prototyping – Laser based and other technologies, Kluwer,2004

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20MEE19

COMPOSITE MATERIALS AND TESTING

(Professional Elective-V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Objectives: Student will understand the

1. Types of composite materials used in commercial composites.
2. Prediction of the properties of UD lamina based on the constituent materials.
3. Method of predicting failure in composite lamina using different theories.
4. Analysis of composite laminates based on classical lamination theory.
5. Fabrication and testing methods of composite materials.

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

1. Understand composite materials, classification, types of matrix and fibre materials.
2. Understand types of analyses, stress strain relationships for different materials and characterization of UD lamina.
3. Understand the variation of properties with orientation and failure theories of UD lamina.
4. Analyze the laminates for stresses and strains using CLT.
5. Summarize the various fabrication methods of composite materials and measurements of properties through tests.

UNIT-I

Introduction: Introduction to composite materials, general characteristics, Fibres, Matrix materials, Interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites, Carbon fibre composites, nanocomposites, Advantages, Applications of composite materials, Military, civil, space, automotive and commercial applications.

UNIT-II

Basic Concepts and Characteristics: Stress strain relations for anisotropic, orthotropic and isotropic materials, Scales of analyses: micromechanics, macro mechanics, Elastic constants of UD lamina using MOM approach, thermal and moisture coefficients, Halpin-Tsai equations, load transfer mechanism from fibre to matrix, Restrictions on engineering constants.

UNIT-III

Elastic behaviour of UD Lamina: Transformation of stress, Strain and elastic parameters reduced and transformed stiffness matrix and compliance matrix, variation of lamina properties with orientation. Tensile and compressive strengths of UD fibre composites, Macromechanical failure theories, Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion and quadratic interaction (Tsai- Wu) criteria.

UNIT-IV

Elastic Behaviour of Laminate: - Laminate Nomenclature, Kirchhoff's Hypothesis, CLT, Laminate strains and displacements - Laminate stresses & strains -Stress distributions through the thickness- Force and moment resultants-Laminate stiffness matrix: ABD Matrix-Classification of laminates and their effect on the ABD Matrix-Elastic couplings.

UNIT-V

Fabrication Processes: Hand lay-up, bag molding, autoclave processing, RTM, pultrusion, filament winding. Case studies on fabrication of composite parts/ boats/pressure vessels/automotive parts/ aerospace parts.

Testing: Fibre and matrix tests, gel time test for resins, curing cycle, tensile test, compressive test, in-plane shear test, inter-laminar shear test, flexural test.

Text Books:

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Co., 2006.
2. B. D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara, Analysis and performance of fiber composites, 3rd edition, Wiley & Sons, 2013.
3. M. Balasubramanian, Composite materials and processing, CRC press, 2014.

Suggested Reading:

1. Isaac M. Daniel and Ori Ishai, Engineering Mechaincs of Composite Materials, Oxford University Press, 1994.
2. Sanjay K. Mazumdar, Composites manufacturing, CRC Press, 2002.

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20MEE20

BLOCK CHAIN TECHNOLOGY

(Professional Elective-V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Objectives:

1. To provide Conceptual understanding of how blockchain technology can be used to improve business processes.
2. To facilitate understanding of bit coin and working with consensus in Bitcoin.
3. To impart knowledge about designing and building Permissioned blockchains.
4. To introduce supply chain management and internet enabled supplychains.
5. To familiarize with blockchain applications.

Course Outcomes: On Successful completion of this course, student will be able to

1. State the basic concepts and design primitives of blockchain.
2. Understand the significance of Consensus mechanisms.
3. Understand different types of blockchain.
4. Demonstrate the significance of blockchain in financial, supply chain and government sector based use cases.
5. Analyze the applications of Blockchain in industry & governance

UNIT- I

Introduction: History, blockchain Architecture, nodes, crypto currency, tokens, cryptography- private and public keys, hash, ledgers, bitcoin, design Primitives- digital Signature, protocols, security, consensus, understanding Crypto currency.

UNIT- II

Bitcoin and block chain: creation of coins, payments and double spending, bitcoin scripts, bitcoin p2p network, transaction in bitcoin network, block mining, block propagation and block relay. Working with consensus in bitcoin: distributed consensus in open environments, consensus in a bitcoin network, proof of work (pow) – basic introduction, hash cash pow, bitcoin pow, attacks on pow and the monopoly problem, proof of stake, proof of burn and proof of elapsed time, the life of a bitcoin miner, mining difficulty, mining pool.

UNIT- III

Permissioned Block chain: Definition, merits and demerits, differences between permissioned and permissionless blockchain, overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT, Byzantine fault tolerant (BFT) system, Lamport-Shostak Pease BFT Algorithm. Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food security, Mortgage over Blockchain, Blockchain enabled Trade.

UNIT- IV

Blockchain and the world economy: Supply chain industry-past and future, supply chain using blockchain technology, building blocks of a supply chain network, business processes in supply chains, types of supply With Effect from the Academic Year 2021-2022 72 chains and examples, strategic, tactical, and operational decisions, supply chain performance measures. ERP and automation. Internet-enabled supply chains: e-marketplaces, e-procurement, e-logistics, e-fulfillment, customer relationship management, web services.

UNIT -V

Applications of blockchain technology: Uses of blockchain in e-governance, land registration, property records, notary, titles, micropayments, medical information systems, next generation of industry 4.0 and additive manufacturing, government identity management, auto executing contracts, three signature escrow, triple entry.

Text Books:

1. Melanie Swan, Block Chain: Blueprint for a New Economy, 1st edition O'Reilly, 2015.
2. Andreas Antonopoulos, Mastering Bitcoin: Unlocking Digital Crypto currencies, 1st edition, O‘Relly, 2015.
3. Tiana Laurence, Introduction to blockchain technology, Van Haren Publishing, ‘s-Hertogenbosch, 2019.

Suggested Reading:

1. Daniel Drescher, Block Chain Basics, 1st edition, Apress, 2017.
2. RiteshModi, Solidity Programming Essentials: A Beginner‘s Guide to Build Smart Contracts for Ethereum and Block Chain, Packt Publishing, 2018

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20CSO05

BASICS OF ARTIFICIAL INTELLIGENCE

(Open Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives: The objectives of this course are,

1. To learn fundamental concepts in Artificial Intelligence.
2. To explore various paradigms involved in solving AI problems involving perception, reasoning and learning.
3. To apply AI concepts for building an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Differentiate between a rudimentary Problem and an AI problem, its Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Appraise knowledge in Uncertainty and Probabilistic reasoning approaches.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

UNIT - I

Introduction: History Intelligent Systems, Foundations of Artificial Intelligence, Sub areas of Al, Applications. **Problem Solving - State - Space Search and Control Strategies:** Introduction, General Problem Solving Characteristics of problem, Exhaustive Searches, Heuristic Search Techniques, Iterative - Deepening A*, Constraint Satisfaction.

UNIT - II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Table, A System in Propositional Logic, Resolution, Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT - III

Uncertainty Measure - Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster - Shafer Theory.

UNIT - IV

Intelligent Agents: Agents vs Software programs, classification of agents, Multi- agent systems, Architecture of intelligent agents, Multi-agent application.

Expert System and Applications: Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools.

UNIT - V

Machine - Learning Paradigms: Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering, Support Vector Machines

Text Books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.
2. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 3rd Edition, Prentice Hall.

Suggested Reading:

1. Rich, Knight, Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Edition, 2009.
2. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.

Online Resources:

1. https://nptel.ac.in/courses/106105077
2. https://nptel.ac.in/courses/106106126

With Effect from the Academic Year 2023 – 24

20CHO06

FUNDAMENTALS OF FUEL CELLS

(Open Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives: This course helps the students to:

1. Create awareness about alternate clean fuel available.
2. Evaluate the concepts and chemistry of fuel cell
3. Examine the details of fuel used in fuel cell technology
4. Explain the application of fuel cell in different sectors
5. Evaluate the fuel cell system balance plant and future opportunities

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

1. Apply know-how of thermodynamics, electro-chemistry and principle of fuel cell
2. Understand the different types of fuel cell
3. Understand the components of hydrogen-based fuel cell
4. Evaluate the performance of fuel cells.
5. Explain the application of fuel cell in transport, stationary and portable sector
6. Understand the impact of this technology in a global and societal context

UNIT - I

Introduction: Electrochemical Systems and Fuel Cell, Fuel Cell Fundamentals and Basic Concepts, Fuel Cell Degradation, Fuel Cell Operation, Types Of Fuel Cell And Its Applications: Direct Carbon Fuel Cell, Solid Oxide Fuel Cell, Polymer Electrolyte Fuel Cell, Alkaline Fuel Cell, Phosphoric Acid Fuel Cell, Molten Carbonate Fuel Cell, Fuel Cell Thermodynamics - Heat, Work Potentials, Prediction of Reversible Voltage, Fuel Cell Efficiency

UNIT – II:

Fuels and Fuel Processing: Introduction, Feedstock for H_2 production: Natural gas, Liquefied petroleum gas, Liquid hydrocarbon Fuels: Gasoline and Diesel, Alcohols- Methanol and Ethanol, Ammonia, Biomass, Fuel processing for fuel cell applications: Desulfurization, fuel reforming, water gas shift reaction, Carbon monoxide Removal

UNIT – III:

Fundamental and Components of Portable Hydrogen Fuel Cell: Introduction, PEM Fuel cell Components and their properties: Membrane, Electrode, Gas diffusion layer, Bipolar plates, Stack design principles, system design, performance analysis, current/voltage, voltage efficiency and power density, ohmic resistance, direct methanol and other non-hydrogen fuel cells, biofuel cell

UNIT – IV:

Application of Fuel Cell: Hydrogen fuel cell use in transport, stationary Fuel cell characterization: - in-situ and ex-situ characterization techniques, i-V curve, frequency response analyses; Fuel cell modelling and system integration: - 1D model - Analytical solution and CFD models.

UNIT – V:
Balance of plant and commercialization issues, Future Opportunities, obstacles and challenges associated in fuel cell systems, impact of this technology in a global and societal context

Text Books

1. Nigel M. Sammes ,Fuel Cell Technology, Reaching Towards Commercialization,Springer London, 2006
2. David A Berry, Dushyant Shekhawat, J.J. Spivey, Fuel Cells: Technologies for Fuel Processing, Elsevier Science, 2011

Suggested Readings

1. Shigenori Mitsushima, Viktor Hacker Fuel Cells and Hydrogen, From Fundamentalsto Applied Research, Elsevier Science, 2018

With Effect from the Academic Year 2023 – 24

20CEO02

DISASTER AND RISK REDUCTION MANAGEMENT

(Open Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

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

1) Identify and understand the concepts of hazards, causes and impacts of disasters.
2) Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management;
3) Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe;
4) Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction
5) Evaluate DM study including data search, analysis and presentation as a case study.

UNIT I

- Hazard and disaster-concepts, vulnerability and risk
- Hazard and disaster type – Natural, Water- related, Pandemic and Human induced hazards disasters
- Causes and Impacts of disasters – Impacts on natural eco systems: physical, psychological and social impact
- Disaster and financial resilience
- GIS and remote sensing
- Disaster vulnerability profile of India –Specific to geographical regions and states (as per regional significance)

UNIT 2

- Disaster Management Cycle –Rescue, Relief, Rehabilitation, Prevention, Mitigation and Preparedness
- Disaster risk reduction {DRR) –Community based DRR, institutions concerned with safety, disaster mitigation and construction techniques as per Indian standards
- Early warning systems

UNIT 3

- Trauma and stress management
- First aid and emergency procedures
- Awareness generation strategies for the community on safe practises in disaster (as per regional significance)

UNIT 4

- Components of disaster management –preparedness of rescue and relief, mitigation, rehabilitation &reconstruction
- Institutional frame work of disaster management in India (NDMA-SDMA, NDRF, Civic volunteers, NIDM)
- Phases of disaster/risk management and post-disaster responses
- Compensation and insurance
- Applications of remote sensing &GIS in disaster management

UNIT 5

- Capacity building for disaster/damage mitigation (structural and non structural measures).
- Disaster risk reduction strategies and national disaster management guidelines
- Disaster management Act -2005
- Regional issues as per regional requirement/university can take minimum two topics as per high powered committee

Books:

1. Singh, R. (2017), "Disaster management Guidelines for Earth quakes, Landslides, Avalanches and Tsunami". Horizon Press publications.
2. Taimpo (2016), "Disaster management and preparedness". CRC Press Publications
3. Nidhi, G.D. (2014), "Disaster management preparedness" .CBS Publications Pvt. Ltd.
4. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S. (2013), "Flood Disaster Risk Management-CBS Publications Pvt Ltd.
5. Singh, R. (2016), "Disaster management Guidelines for Natural Disasters" Oxford University Press Pvt. Ltd.

With Effect from the Academic Year 2023 – 24

20ECO05

SYSTEM AUTOMATION AND CONTROL

(Open Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Prerequisite: Knowledge about physical parameters in industry is required

Course Objectives:

This course aims to:

1. Learn the concepts industrial control systems
2. Learn how to measure the physical parameters in industry
3. Learn the applications of Robots in industry.

Course Outcomes:

After completion of this course, students will be able to:

1. Understand the features of various automatic and process control systems.
2. Define and analyze various measuring parameters in the industry.
3. Compare performance of various controllers (P, PD, PI, and PID).
4. Illustrate the role of digital computers in automation.
5. Develop various robot structures for different applications.

UNIT-I

Introduction to Automatic Control Systems: Purpose of Automatic Control, How an Industrial Control System is implemented, Introduction to Automatic Control theory.

Sensors: Sensor definition, Different types of Sensors:Motion, Position, Force, Level sensors, and Thermo couples.

UNIT-II

Theory of Measurements: Measurement goals and concepts, Scale factor, Linearity, accuracy, Range, Resolution, Precision and repeatability.

Measurement Techniques and Hardware: Typical Sensor outputs, Bridge measurements: General equation for bridge balance, Resistance balanced Wheatstone bridge, Variable voltage type measurements, Frequency type measurements.

UNIT-III

Process Controllers: What is a Controller, uses of Controllers, Open loop and closed loop Control, proportional, PD, PI, PID Controllers, Analog and Digital methods of Control.

Controller Hardware: Analog and Digital Controllers.

UNIT-IV

Digital Computers as Process Controllers: Use by Digital Computer for process control, Information required by the computer, Information required by the process, Computer Interface electronics, Digital Computer input-output, computer processing of data, Digital Process control computer design, Computer programming.

Actuators: Electro mechanical - Linear motion and rotary motion solenoids, DC motors, AC motors and Stepped motors.

UNIT-V

Robots: What are robots, Robots and process Control systems, Degrees of freedom, factories of the future, Delivery, Disposal and transport systems, Sensing elements, Robot Classifications and Applications. Trouble shooting System failures: Preliminary steps and other troubleshooting aids.

Text Books:

1. Ronald P. Hunter, "Automated process control systems – concepts and Hardware", 2/e, PHI, 1987.
2. Norman A. Anderson, "Instrumentation for process measurement and Control", 3/e, CRC Press, 2005.

Suggested Reading:

1. Kuo B. C, "Automatic Control Systems", 9th edition
2. A.K Sawhney,"A course on Electrical and Electronic Measurements and Instrumentation".

With Effect from the Academic Year 2023 – 24

20EGO01

TECHNICAL WRITING SKILLS

(Open Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

The course will introduce the students to:

1. Process of communicationand channels of communicationin general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes :

After successful completion of the course students will be able to:

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

Unit I

Communication – Nature and process.
Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.
Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

Unit II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

Unit III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles : Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

Unit IV

Technical Reports : Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals : Definition, types, characteristics, structure and significance.

Unit V

Mechanics of Meetings : Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.
Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Book :

1. Meenakshi Raman & Sangeeta Sharma, **"Technical Communications-Principles and Practice",** Oxford University Press, Second Edition, 2012.
2. 1.M Ashraf Rizvi, **"Effective Technical Communication",** Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading :

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1. .Kavita Tyagi & Padma Misra, **"Basic Technical Communication",** PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, **"Business Correspondence and Report Writing",** Tata McGraw Hill, 2003

Web Resources:

1. **https://onlinecourses.nptel.ac.in/noc18_mg13/preview**
2. **https://www.technical-writing-training-and-certification.com/**
3. **https://academy.whatfix.com/technical-writing-skills**

With Effect from the Academic Year 2023 – 24

20ITO02

PRINCIPLES OF INTERNET OF THINGS

(Open Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives:

1. To provide an overview of Internet of Things, building blocks of IoT and real-world applications.
2. To explore various IOT enabling technologies.
3. To facilitate students, understand Python scripts for IoT platform.
4. To identify steps in IOT design Methodology.
5. To introduce about the Raspberry Pi device, its interfaces and Django Framework.

Course Outcomes:

Upon completing this course, students will be able to:

1. Comprehend the terminology, protocols and communication models of IoT.
2. Define the various IoT enabling technologies and differentiate between M2M and IoT.
3. Acquire the basics of Python Scripting Language used in developing IoT applications.
4. Describe the steps involved in IoT system design methodology.
5. Design simple IoT systems using Raspberry Pi board and interfacing sensors with Raspberry Pi.

UNIT-I

Introduction & Concepts: Introduction to Internet of Things- Definitions & Characteristics of IoT, Physical Design of IOT-Physical Layer, Network Layer, Transport Layer, Application Layer, Things in IoT, IoT Protocols, Logical Design of IOT-Nonfunctional Blocks, IoT Communication Models-Requestreponse,Publisher-Subscriber, Push-Pull, Exclusive Pair, IoT Communication APIs-REST API, Websocket API,

UNIT-II

IOT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IOT Levels & Deployment Templates. Differences and similarities between IOT and M2M, Domain Specific IoT's – IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

UNIT-III

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flowif, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling,

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational

View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi about the Raspberry Pi board, Raspberry Pi interfaces-Serial, SPI, I2C, Other IoT Devices pcDuino, BeagleBone Black, Cubieboard. Python Web Application Framework: Django Framework-Roles of Model, Template andView

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach, Universities Press, 2015.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

Suggested Reading:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From
2. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Willy Publications.

Web Resources:

1. The Internet of Things - Article https://dl.acm.org/citation.cfm?id=1862541
2. Internet of Things - Tutorial
3. http://archive.eurescom.eu/~pub/abouteurescoiem/message_2009_02/Eurescom_message_02_2009.pdf

With Effect from the Academic Year 2023 – 24

20CSO02

INTRODUCTION TO WEB TECHNOLOGY

(Open Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives: The objectives of this course are,

1. To acquire knowledge on XHTML, Java Script and XML to develop client side web applications.
2. To learn developing web applications using PHP.
3. To understand the database access through the web.

Course Outcomes: On successful completion of the course, students will be able to,

1. Understand the technologies required for developing web application.
2. Identify and choose XHTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
3. Design and Develop interactive and innovative web pages using various platforms/technologies like XHTML, CSS, XML, JAVASCRIPT.
4. Create and deploy web applications in web server by using server-side programming concepts like PHP
5. Build a data driven web site using Databases.
6. Evaluate different web applications to implement optimal solutions for real time problems

UNIT - I

Fundamentals: Introduction to the Internet, WWW Browsers, Web Servers, URL, MIME, HTTPS.
Introduction XHTML: Basic Syntax Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists Tables, Forms, Cascading Style Sheets.

UNIT - II

Bootstrap: Introduction to bootstrap.
XML: Introduction, uses of XML, the Syntax of XML, XML Document Structure, DTD, Namespaces, XML schemas, displaying Raw XML Documents, displaying XML documents with CSS, XSLT style Sheets.

UNIT - III

The Basics of Java script: Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements.
Dynamic Documents with Java Script: Positioning Elements, Moving Elements, Changing Colors and Fonts, Dynamic Content.

UNIT - IV

Introduction to PHP: Overview of PHP, General Syntactic Characteristics, Primitives, Operations, and Expressions, Output, Control Statements. Arrays, Functions, Pattern Matching, Form Handling, Cookies, Session Tracking.

UNIT - V

Database Access through the Web: Relational Databases, an Introduction to the Structured Query Language, Architectures for Database Access, the MySQL Database System.

Introduction to PHP MyAdmin, connection to MySQL server from PHP, execution of MySQL queries from PHP, receiving data from database server and processing it on webserver using PHP.

Text Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg, "Internet and World Wide Web How to program", Pearson Education, 3rd edition, 2003.
2. Robert W. Sebesta, "Programming the World Wide Web", Pearson Education, 4th Edition, 2008.
3. Adams, "PHP Programming the Complete Guide", 2022.

Suggested Reading:

1. Chris Bates, "Web Programming: building internet applications", Wiley, Second edition, 2002.
2. Steven Holzner, "The Complete Reference PHP", McGraw Hill Education; Raunak PHP study edition, 2017.

With Effect from the Academic Year 2023 – 24

20ECO04

PRINCIPLES OF EMBEDDED SYSTEMS

(Open Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives: Fundamental knowledge about electronic device is required

This course aims to:

1. To learn the fundamentals of the embedded system design.
2. To learn architecture details of embedded processors
3. To analyze various embedded applications and debugging tools.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand hardware and software details of embedded system.
2. Analyze the architecture and instruction set of embedded processors.
3. Develop the embedded system design cycle
4. Apply various debugging tools for embedded system applications.
5. Design different case studies for embedded applications

UNIT I

Introduction to Embedded systems: Embedded systems vs General computing systems, Classifications, Applications areas, Processor embedded into a system, Processor selection for embedded system, Embedded hardware units and devices in a system, Design metrics and Challenges in embedded system design.

UNIT II

Embedded Processors: PIC 18 Family Overview, Architecture, Instruction Set, Addressing modes, Timers and Interrupts of PIC 18. Capture/Compare and PWM modules of PIC 18.

UNIT III

Introduction to advanced processor architectures: ARM design philosophy. ARM data flow model, Register organization, Program Status Register, Pipeline, Introduction to exceptions. ARM instruction set.

UNIT IV

Embedded System Design Cycle: Embedded system design and co-design issues in system development process, Design cycle in the development phase for an embedded system. Embedded software development tools: Host and Target machines, Linker/Locators for embedded software, Embedded software into the target system.

UNIT V

Debugging tools and Applications: Integration and testing of embedded hardware, testing methods, Debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, Simulator, Emulator and In-Circuit Emulator, IDE. **Case Studies:** Design of Embedded Systems using Microcontrollers – for applications in the area of communications and automotives. (GSM/GPRS, CAN, Zigbee).

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design," 3/e, Tata McGraw Hill Education, 2015.
2. Andrew N.SLOSS, DomonicSymes Chris Wright "ARM System Developers Guide- Designing and optimizing system software" ELSEVIER 1st Edition2004.
3. Mazidi, MCKinlay and Danny Causey, "PIC Microcontrollers and Embedded Systems", Pearson Education. 2008

Suggested Readings:

1. David E.Simon, "An Embedded software primer", Pearson Education,2004.
2. Steve Furber "ARM System on Chip Architecture" 2/e Pearson education, 2000.

With Effect from the Academic Year 2023 – 24

20PYO01

HISTORY OF SCIENCE AND TECHNOLOGY

(Open Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives: The objectives of the course is to make the student

1. Gains the knowledge about origin of science in the Stone Age and its progress during Antiquity period.
2. Familiar with scientific views in the Medieval period and during the Industrial revolution. .
3. Aware of modern scientific developments from 19th century onwards.

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

1. Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
2. Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
3. Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
4. Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.
5. Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.

Unit-I

Science - The Beginning (through 599 BCE): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances.

Science in Antiquity (600 BCE - 529 CE): Philosophy- a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, Major advances.

Unit-II

Medieval Science (530 CE - 1452 CE): The decline of science in Europe, Science in China, Science and mathematics in India, Arab science, Revival of science in Europe, Technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 CE – 1659 CE): Renaissance, Scientific Revolution, Technology, Major advances.

Unit-III

Scientific Method: Measurement and Communication (1660 CE – 1734 CE): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 CE – 1819 CE): Industrial Revolution, Rise of the engineer, Major Advances.

Unit-IV

Science and Technology in the 19th Century (1820 CE – 1894 CE): Philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 CE – 1945 CE): The growth of 20thcentury science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in technology, Major advances.

Unit-V

Big Science and the Post-Industrial Society (1946 CE – 1972 CE): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 CE – 2015 CE): Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Text Books:

1. Bryan Bunch and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company (New York), 2004
2. JD Bernal, "Science in History", 4 Volumes, Eklavya Publishers, 2012

Suggested Readings:

1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010
2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016

With Effect from the Academic Year 2023 – 24

20ADO01

INTRODUCTION TO PYTHON PROGRAMMING

(Open Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives:

1. To introduce the python programming environment.
2. To impart knowledge basics data types and operation.
3. To familiarize with function, tuple, dictionary to process the data.
4. To introduce various packages in python
5. To familiarize class, object, exception handling and working with files.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Explore data operations on list, tuple and dictionary in python.
2. Understand deployment of models on different datasets.
3. Apply supervised, unsupervised, resembling and NLP models on different datasets.
4. Perform data analysis using python packages.
5. Build and evaluate the models using python programming.

UNIT-I:

Introduction: Historical introduction to python, Installing Python, python interpreter and its environment: Argument passing and interactive mode, source encoding; Informal introduction to python: Python as calculator: Numbers, Strings, Lists, Programming steps.

UNIT - II

Control Statements and functions: control flow tools: if statement**,** for statements, range function, break and continue statements, else clauses on loops, pass and match statements; Defining function: default and keywords argument valuses, special parameters: positional-or-keywords arguments, positional parameters, keywords arguments, function examples, Arbitrary and Unpacking argument lists, lambda expression, documentation strings, function annotations, coding style, Input and output, reading and writing files.

UNIT - III

Data structures and Modules: More on lists: Lists as stack and queues, list comprehensions, nested list comprehensions, del statement, Tuples and sequences, sets and operations, Dictionaries, looping and conditional statements on dictionary; Modules: Executing modules as scripts, module search path, compiled python files, standards modules, dir() function, packages: Importing * from packages, intra packages references, packages in multiple directories, error and exception handling.

UNIT - IV

Design with Classes: Classes and Objects, python scopes and namespaces, class defining syntax: class objects, instances, method objects, instances variables, Inheritance, private variables, odds and ends, Iterators, generators and their expressions, standards library: OS interfaces and string pattern matching, virtual environment and packages, pip, floating point arithmetics: issue and limitations, error representation.

UNIT - V

Graphical User Interfaces: GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons. Simple Graphics and Image Processing: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing, GUI case studies.

Text Book:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning. 2. Think Python First Edition, by Allen B. Downey, O'reilly publishing

Suggested Reading:

1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing
3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)

Web Resources:

1. https://python.org/tutorial/
2. Joy of computing Nptel course by prof. Sudersan Iyengar, IIT Roper
3. https://www.udemy.com/course/python-programming-beginner-to-advanced

20EGM04 With Effect from the Academic Year 2023 – 24

GENDER SENSITIZATION

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	50	Marks
CIE	0	Marks
Credits	0	

Course Objectives

This course will introduce the students to:

1. Sensibility regarding issues of gender in contemporaryIndia.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Course Outcomes

After successful completion of the course the students will be able to:

1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructedtheories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding ofpersonal life, the workplace, the community and active civic engagementthrough classroom learning.

UNIT – I
Understanding Gender:
Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)
Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste.DifferentMasculinities.

UNIT – II
Gender And Biology:
Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many? Struggles with Discrimination.

UNIT – III
Gender andLabour:
Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV
Issues Of Violence
Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.
Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V
Gender: Co - Existence
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu **"Towards a World of Equals: A Bilingual Textbook onGender"** published by Telugu Akademi, Hyderabad,Telangana State, **2015**.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. **"I Fought For My Life…and Won."**Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:
1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

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Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

With Effect from the Academic Year 2023 – 24

20MBC01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives: The Objectives of the Course are:

1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

Unit-I Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

Unit-II Demand and Supply Analysis

Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

Unit-III Production and Cost Analysis

Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.

Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

Unit-IV Accountancy
Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

Unit-V Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Text Books:

1. Mehta P.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013.

Suggested Readings:

3. Panday I.M. "Financial Management", 11th edition, VikasPublishing House, 2015.
4. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
5. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
6. A. R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2013.

With Effect from the Academic Year 2023–24

20MEC33

PROJECT PART-1

Instruction	4	Hours per week
Duration of SEE	----	
SEE	----	
CIE	50	Marks
Credits	2	

Objective: The objectiveof Project Part -1 is to enable the student take up investigative study in the broad field ofEngineering / Technology, either fully theoretical/practical or involving both theoretical and practicalwork to be assigned by the Department on an individual basis or two/three students in a group, undertheguidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D.

Outcomes: At the end of the course, the students are able to

1. Identify a topic in advanced areas of Mechanical / Allied fields of Engineering.
2. Review literature to identify the gaps, define the objectives and scope of the work.
3. Generate innovative ideas for societal benefit and Nation building.
4. Develop prototypes/models, experimental setup and software systems necessary to meet the objectives.
5. Prepare a technical report and present before the departmental committee

The work shall include:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for Presentation to the Department.
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of marks:

Evaluation by	Maximum Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Departmental Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

With effect from the academic year 2023-24

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instruction as per R20 Curriculum

B.E. (MECHANICAL ENGINEERING)

SEMESTER – VIII

S. No.	Course Code	Title of the Course	Scheme of instruction			Scheme of examination			Credits
			Hours per week			Duration in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1		Open Elective - IV	3	--	--	3	40	60	3
PRACTICALS									
2	20MEC34	Technical Seminar	--	--	2	--	50	--	1
3	20MEC35	Project Part-2	--	--	12*	--	100	100	4
TOTAL			**3**	**--**	**14**	**--**	**190**	**160**	**8**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE – Semester End Examination

*180 hours for the students working on the paid internship during VIII semester

Open Elective-IV (3/3)		
S. No.	**Subject Code**	**Name of the Subject**
1	20ITO03	Introduction to Cloud Computing
2	20CSO08	Basics of Machine Learning
3	20ECO06	MEMS and its Applications
4	20EEO05	Waste Management
5	20BTO02	Biomaterials for Engineers

With Effect from the Academic Year 2023 – 24

20ITO03

INTRODUCTION TO CLOUD COMPUTING

(Open Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives:

The Objectives of the Course are:

1. To impart the basics of cloud computing for business management.
2. To illustrate and explore the benefits of cloud storage and its applications, usage by managers.
3. To enable students explore cloud computing driven real time systems.

Course Outcomes:

After Completion of the Course, Students will be able to:

1. Understand the characteristics and models in Cloud computing.
2. Asses Cloud services applications and the challenges associated with Cloud Computing.
3. Apply various cloud services and deployment models and virtualization techniques for business.
4. Analyze the concepts of cloud storage and demonstrate their use.
5. Evaluate various cloud programming models and apply them in virtual office management.

UNIT-I

Cloud Computing Overview: Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling , Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

UNIT-II

Cloud Insights: Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.

UNIT-III

Cloud Architecture- Layers and Models: Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption.
Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

UNIT-IV

Cloud Simulators- CloudSim and GreenCloud : Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud

UNIT-V

Introduction to VMWare Simulator: Basics of VMWare, advantages of VMware virtualization, using VMware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Text Book:

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010

Suggested Reading:

1. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
2. Cloud computing for dummies- Judith Hurwitz, Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
3. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

Web Resource:

1. https://nptel.ac.in/courses/106105167/1

With Effect from the Academic Year 2023 – 24

20CSO08

BASICS OF MACHINE LEARNING

(Open Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives: The objectives of this course are,

1. To learn Machine Learning algorithms.
2. To learn to work with data's, preparing datasets for real world problems
3. To study various machine learning algorithms.
4. To analyze data using machine learning techniques.
5. To become familiar with usage of time series and deep learning approaches.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Define the basic concepts related to Python and Machine Learning
2. Describe the feature engineering methods, regression techniques and classification methods
3. Apply Python packages for data visualization, text and time series data analysis using NLP toolkit
4. Evaluate and interpret the results of the various machine learning techniques
5. Solve real world problems using deep learning framework.

UNIT - I

Introduction to Machine Learning: Introduction, types of learning, Machine Learning process.
Introduction to Python: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. Principal component analysis (PCA).
Data Visualization: Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression.
Classification: Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes, Support Vector Machines (SVM).

UNIT - IV

Unsupervised Learning: Clustering, types of clustering, K-Means clustering, Hierarchical clustering.
Text Analysis: Basic text analysis with Python, regular expressions, NLP, text classification.
Time Series Analysis: Date and time handling, window functions, correlation, time series forecasting

UNIT - V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework.

Recommender System: Recommendation engines, collaborative filtering.

Text Books:

1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018.
2. Tom Mitchel "Machine Learning", Tata McGraw Hill, 2017.

Suggested Reading:

1. Marsland, S. "Machine Learning: An Algorithmic Perspective" 1st Edition, Chapman and Hall/CRC, 2009. https://doi.org/10.1201/9781420067194
2. Yuxi Liu, "Python Machine Learning by Example", 2nd Edition, PACT, 2017.

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

With Effect from the Academic Year 2023 – 24

20ECO06

MEMS AND ITS APPLICATIONS

(Open Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives: Knowledge of sensors is required
This course aims to:

1. Provide knowledge of semiconductors, various materials used for MEMS.
2. Introduce various Electrostatic and Thermal Sensors and Actuators.
3. Educate on the applications of MEMS to various disciplines.

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

1. Understand various materials used for MEMS.
2. Design the micro devices and systems using the MEMS fabrication process.
3. Analyze the operation of different Sensors and Actuators.
4. Interpret the micro devices and systems using Polymer MEMs.
5. Apply different MEMS devices in various disciplines.

UNIT- I

Introduction: The History of MEMS Development, The Intrinsic Characteristics of MEMS: Miniaturization, Microelectronics Integration, Parallel Fabrication with Precision, Devices: Sensors and Actuators- Energy Domains and Transducers, Sensors Considerations, Sensor Noise and Design Complexity: Actuators Considerations.

UNIT- II

Introduction to Micro Fabrication: Overview of Micro fabrication, Overview of Frequently used Micro fabrication Processes: Photolithography, Thin Film Decomposition, Thermal Oxidation of Silicon, Wet Etching, Silicon Anisotropic Etching, Plasma Etching and Reactive Etching, Doping, Wafer Dicing, Wafer Bonding, Microelectronics Fabrication Process Flow, Silicon based MEMS Processes, Packaging and Integration, Process Selection and Design.

UNIT- III

Electrostatic Sensing and Actuation: Introduction to Electrostatic Sensors and Actuators, Parallel: Plate Capacitor, Applications of Parallel Plate Capacitors, Interdigitated Finger Capacitors, Applications of Combo Drive Devices: Inertia Sensors, Actuators. Thermal Sensing and Actuation: Introduction to Thermal Sensors, Thermal Actuators, Fundamentals of Thermal Transfer, Sensors and Actuators Based on Thermal Expansion, Thermal Couples, Thermal Resistors, Applications- Inertia Sensors, Flow Sensors, Infrared Sensors.

UNIT- IV

Piezo resistive Sensors: Origin and Expression of Peizo resistivity, Piezo resistive Sensor Materials: Metal Strain Gauges, Single crystal Silicon, Polycrystalline Silicon, Applications of Piezo resistive Sensors: Inertial sensors, Pressure Sensors, Tactile Sensors, flow Sensors. Piezoelectric Sensors: Introduction, Properties of Piezoelectric Materials, Applications- Inertia Sensors, Acoustic Sensors, Tactile Sensors, Flow Sensors.

UNIT- V

Polymer MEMS: Introduction, Polymers in MEMS- Polyimide, SU-8, Liquid Crystal Polymer (LCP), Representative Applications- Acceleration Sensors, Pressure Sensors, Flow Sensors, Tactile Sensors. Case Studies of Selected MEMS Products: Blood Pressure (BP) Sensor, Microphone, Acceleration Sensor and Gyros.

Text Books:

1. Chang Liu, "Foundations of MEMS", 2/e, Pearson Education Inc., 2012.
2. Tai Ran Hsu, "MEMS & Micro Systems Design and Manufacture", Tata McGraw Hill, 2002.

Reference Books:

1. P. Rai Choudary, "MEMS and MEMS Technology and Applications", PHI publications, 2009.
2. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC press, 2001.

With Effect from the Academic Year 2023 – 24

20EEO05

WASTE MANAGEMENT

(Open Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Course Objectives:

1. To Imbibe the concept of effective utilization of any scrap
2. To become familiar with the processes of all disciplines of engineering.
3. To learn the technique of connectivity from waste to utility.

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

1. Categorize the waste based on the physical and chemical properties.
2. Explain the Hazardous Waste Management and Treatment process.
3. Illustrate the Environmental Risk Assessment, methods, mitigation and control.
4. Interpret the Biological Treatment of Solid and Hazardous Waste.
5. Identify the waste disposal options, describe the design and construction, Operation, Monitoring,Closure of Landfills

UNIT-I

Introduction to waste management and Municipal Solid Waste Management: Classification of waste: Agro based, Forest residue, Industrial waste, e-Waste, Municipal Solid Waste Management: Fundamentals Sources, composition, generation rates, collection of waste, separation, transfer and transport of waste, treatment and disposal options.

UNIT-II

Hazardous Waste Management and Treatment: Hazardous Waste Identification and Classification, Hazardous Waste Management: Generation, Storage and collection, Transfer and transport, Processing, Disposal, Hazardous Waste Treatment: Physical and Chemical treatment, Thermal treatment, Biological treatment, Pollution Prevention and Waste Minimisation, Hazardous Wastes Management in India.

UNIT-III

Environmental Risk Assessment: Defining risk and environmental risk, Parameters for toxicity quantification, Types of exposure, Biomagnifications, Effects of exposure to toxic chemicals, risk analysis and risk matrix, methods of risk assessment, mitigation and control of the risk, case studies.

UNIT-IV

Biological Treatment: Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

UNIT-V

Waste Disposal: Key Issues in Waste Disposal, Disposal Options and Selection Criteria: Disposal options, Selection criteria, Sanitary Landfill: Principle, Landfill processes, Landfill Gas Emission:

Composition and properties, Hazards, Migration, Control, Leach ate Formation: Composition and properties. Leach ate migration, Control, Treatment, Environmental Effects of Landfill, Landfill Operation Issues, Design and construction, Operation, Monitoring, Closure of Landfills - Landfill Remediation, national and International Waste management programs

Text Books:

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous WasteManagement, McGraw Hill International Editions, New York, 1994
3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors JohnWiley and Sons, New York, 1997

Suggested Reading:

1. Basics of Solid and Hazardous Waste Mgmt. Tech. by KantiL.Shah 1999, Prentice Hall.
2. Solid and Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist.

20BTO02

BIOMATERIALS FOR ENGINEERS

(Open Elective-IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	60	Marks
CIE	40	Marks
Credits	3	

Prerequisites: Undergraduate First year basic concepts of physics and chemistry are required

Course Objectives:

Students are made to understand the following concepts during their course of time:

1) To learn the types and trends of Biomaterials.
2) To recognize the procedures for manufacturing of Metallic Biomaterials.
3) To be aware of the types of ceramic Biomaterials.
4) To elaborate the detailed features of polymer and composite Biomaterials.
5) To learn the applications of Biomaterials.

Course outcomes:

By the end of the course the students are able to

1) Explain types and properties of Biomaterials.
2) Compare the techniques for manufacture of metallic Biomaterials and their use in health care industry.
3) Outline the physiological properties and various techniques for manufacture of ceramic biomaterials.
4) Illustrate the preparation of polymer and composite Biomaterials.
5) Apply the different type of Biomaterials in health industry.

UNIT-I

Introduction to Biomaterials: Introduction andimportance of biomaterials;Types of biomaterials: metallic, ceramic, polymeric and composite biomaterials; Future trends in biomaterials.

UNIT-II

Metallic Biomaterials: Properties of metallic biomaterials;Stainless steels; CoCr alloys; Ti alloys;Corrosion of metallic implants;Manufacturing of implants. Dental implant and their biocompatibility

UNIT-III

Ceramic Biomaterials: Properties of ceramic biomaterials;Classification according to physiological response of ceramic biomaterials: bioinert, bioactive and bioresorbable ceramics;Deterioration of ceramics;Bio ceramicmanufacturing techniques

UNIT-IV

Polymeric and composite biomaterials: Polymerization and basic structure;Polymers used as biomaterials; Properties of polymeric and composite biomaterials; Sterilization;Surface modifications for improving biocompatibility;Surface-protein interactions.

UNIT-V

Applications of Biomaterials: Applications of biomaterials in tissue engineering; Drug delivery; Biosensing; Diagnostics.

Text Books:

1. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E An Introduction to Materials in Medicine, (Elsevier Academic Press, ISBN: 0-12-582463-7),2002.
2. 2.J.B. Park and J.D. Bronzino. Biomaterials: Principles and Applications. CRC Press. 2002. ISBN: 0849314917
3. K.C. Dee, D.A. Puleo and R. Bizios. An Introduction to Tissue-Biomaterial Interactions. Wiley 2002. ISBN: 0-471-25394-4.

Reference Books

1. T.S. Hin (Ed.) Engineering Materials for Biomedical Applications. World Scientific. 2004. ISBN 981-256-061-0
2. B. Rolando (Ed.) Integrated Biomaterials Science. Springer. 2002. ISBN: 0-306-46678-3.

20MEC34

TECHNICAL SEMINAR

Instruction	2	Hours per week
Duration of SEE	----	
SEE	----	
CIE	50	Marks
Credits	1	

Objective: The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the studentshall read further relevant articles in the domain.

Outcomes: At the end of the course, the students are able to

1. Identify the recent advances in the field of engineering/technology.
2. Develop the skills and expertise in report writing.
3. Compile the content and prepare comprehensive report.
4. Demonstrate skills required for preparation of a technical report.
5. Present technical know-how and professional skills before the committee.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the noticeboard.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by question and answers session for 10minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged. For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall be preferably from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20
Total Marks		**50**

20MEC35

PROJECT PART-2

Instruction	12	Hours per week
Duration of SEE	----	
SEE	100	
CIE	100	Marks
Credits	4	

Objectives: The objective of Project Part-2 is to enable the student extend further the investigative study taken up, either fully theoretical/practical or involving both theoretical and practical work, under the guidance ofa Supervisor from the Department alone or jointly with a Supervisor drawn from R&Dlaboratory/Industry. This is expected to provide a good training for the student(s) in R&D work andtechnical leadership.

Outcomes: At the end of the course, the students are able to

1. Summarize the literature review for the identified problem.
2. Identify methods and materials to carry out experiments/ develop code/simulation.
3. Integrate the methodology and engineering tools adopted for solving the problem.
4. Analyze and discuss the results to draw valid conclusions.
5. Exhibit knowledge, skill, attitude and technical knowhow in preparing report as per format andpresenting as a professional engineer.

The assignment to normally include:

1. In depth study of the topic assigned.
2. Review and finalization of the Approach to the Problem relating to the assigned topic.
3. Preparing an Action Plan for conducting the investigation, including teamwork.
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
5. Final development of product/process, testing, results, conclusions and future directions.
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible.
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE:

Evaluation by	Maximum Marks	Evaluation Criteria / Parameter
Department Review Committee	10	Review 1
	15	Review 2
	25	Submission
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Report Preparation
	10	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE:

Evaluation by	Maximum Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live research projects • Scope for future study • Application to society
	20	Viva-Voce