VISHNU INSTITUTE OF TECHNOLOGY:: BHIMAVARAM
(Autonomous)
Approved by AICTE, Accredited by NBA, NAAC & Affiliated to JNTUK, Kakinada
MECHANICAL ENGINEERING DEPARTMENT

III-Year II-Semester

S. No	Course Title	L	T	P	C
1	CAD/CAM	3	-	-	3
2	Heat Transfer	3	-	-	3
3	**Professional Elective-II** Advanced Machine Design Mechanical Vibrations Design Thinking & Product Innovation Robotics	3	-	-	3
4	**Open Elective-III (Inter Disciplinary Elective – II)** Solar Energy Systems Soft Computing Techniques Internet of Things Solid Waste Management	3	-	-	3
5	**Humanities Elective-I** Managerial Economics & Financial Analysis Life Sciences for Engineering Foreign Language	3	-	-	3
6	CAD/CAM Lab	-	-	3	1.5
7	Heat Transfer Lab	-	-	3	1.5
8	Quantitative Aptitude – II	-	-	2	1
9	Mini Project	-	-	4	2
	Total	15	-	12	21

III B.Tech II Semester

CAD/CAM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The general objectives of the course are to enable the students to

1. To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc
3. To understand the different geometric modelling techniques like solid modelling, surface modelling, feature based modelling etc.
4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control
5. To learn the overall configuration and elements of computer integrated manufacturing systems.

UNIT I

Introduction: Computers in Industrial Manufacturing, Product cycle, CAD/ CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices and storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modelling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNITII

Geometric Modelling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modelling facilities desired.

Drafting And Modelling Systems: Basic geometric commands, layers, display control commands, editing, dimensioning and solid modelling.

UNIT III

Part Programming for NC Machines: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining centre, turning centre, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT IV

Group Technology: Part family, coding and classification, production flow analysis, Machine cell design, Advantages and limitations.

Computer Aided Process Planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type

UNIT V

Computer Aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods - non optical, computer aided testing, integration of CAQC with CAD/CAM.

UNIT VI

Computer Integrated Manufacturing Systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labour in the manufacturing systems, CIMS benefits.

COURSE OUTCOMES:

At the end of the course the students shall be able to

1. Ability to describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid
2. Ability to describe Memory types, input/output devices, display devices and computer graphics
3. Acquire the knowledge of geometric modelling and Execute the steps required in CAD software for developing 2D and 3D models and perform transformations
4. Explain fundamental and advanced features of NC and CNC machines
5. Ability to describe the use of GT and CAPP for the product development.
6. Identify the various elements and their activities in the Computer Integrated Manufacturing Systems.

TEXT BOOKS:

1. Zimmers&P.Groover, CAD / CAM, PHI,1st Edition,1984.
2. Groover, Automation Production systems & Computer integrated Manufacturing, PE, 4th Edition 2016.

REFERENCE BOOKS:

1. Ibrahim Zeid, CAD/CAM Theory and Practice, McGraw Hill Education India, special Indian Edition,2009.
2. FaridAmirouche, Pearson, Principles of Computer Aided Design and Manufacturing,Pearson publishers, 2nd Edition, 2004.
3. Warren S Seames, Thomson,Computer Numerical Control Concepts and programming, Delmar Cengage Learning,4th Edition,2001.

III B.Tech II Semester

HEAT TRANSFER

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To understand different modes of heat transfer and apply these basics in the design of thermal systems

UNIT I

Introduction: Basic Modes of Heat Transfer, Basic laws of Heat transfer, Steady and Unsteady Heat Transfer.

Heat Conduction: Fourier‘s equation, Thermal resistance, Thermal conductivity: General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates and its simplification-Initial and boundary conditions.

One- Dimensional Steady State Conduction: Conduction through a single and multi-layered plane, cylindrical and spherical walls with constant and variable Thermal conductivity, conduction with uniform heat generation: plane wall and cylinder, critical thickness of insulation.

UNIT II

Heat Transfer From Extended Surfaces: Steady flow of heat along a rod, heat dissipation from an infinitely long fin, Short fin with insulated tip: Fin efficiency and Effectiveness.

One Dimensional Transient Heat Conduction: Systems with negligible internal resistance, Lumped Heat analysis: Significance of Biot and Fourier Numbers, systems with finite surface and internal resistance using Heisler Chart.

UNIT III

Convective Heat Transfer: Classification of Convective Heat Transfer, Dimensional analysis, Buckingham Pi Theorem for forced and Natural convection, Continuity, Momentum and Energy Equations.

Forced Convection: Concepts of hydrodynamic and thermal boundary layer, use of empirical correlations for forced convective heat transfer: Internal flows and External flows.

Natural Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate, Use of empirical relations for Vertical plates and cylinders.

UNIT IV

Boiling: Pool boiling, Regimes, Nucleate boiling and Film boiling, Critical Heat flux, Flow boiling, Sub cooled boiling, saturated boiling, Boiling Flow patterns (Vertical & Horizontal).

Condensation: Film wise and drop wise condensation: Film condensation on vertical and horizontal cylinders, using empirical correlations.

UNIT V

Radiation Heat Transfer: Basic concepts, Emission characteristics, concept of black body, laws of black-body radiation - Planck’s law, Wien’s displacement law, Stefan Boltzmann law, radiation incident on a surface, solid angle and radiation intensity, lambert’s cosine law, heat exchange between two black surfaces, shape factor, heat exchange between non-black surfaces, radiosity, electrical analogy for radiation networks, radiation shields.

UNIT VI

Heat Exchangers: Introduction, Classification of heat exchangers, Flow arrangement, Temperature distribution, Overall heat transfer coefficient, Fouling factor, LMTD method of Heat exchanger analysis, Correction for LMTD for use with Multi pass and Cross flow Heat Exchangers, Effectiveness, NTU method of Heat Exchanger analysis, Applications of Heat Exchangers.

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to

1. Determine the rate of heat transfer through simple geometries in steady state and find the critical radius of insulation in case of steam pipes and electrical cables.
2. Evaluate the rate of heat transfer from a finned surface and the time of cooling Or heating in transient heat conduction problems.
3. Compute convective heat transfer coefficients in forced and natural convection, both for internal and external flows.
4. Find the convective heat transfer coefficient in boiling and condensation.
5. Calculate the radiation heat exchange between the surfaces and interpret the significance of radiation shields.
6. Design a heat exchanger using LMTD or NTU method.

TEXT BOOKS:

1. R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New age publication, 5th Edition, 2017.
2. Yunus A. Cengel&Afshin J. Ghajar, Heat and Mass Transfer - Fundamentals and Applications, Tata McGraw Hill, 6th Edition, 2020.

REFERENCE BOOKS:

1. N. Ozisik, Heat Transfer - A Basic Approach, Tata McGraw Hill, 1985.
2. P. K. Nag, Heat and Mass Transfer, Tata McGraw Hill, 3rd Edition, 2011.
3. J. P. Holman, Heat Transfer, Tata McGraw Hill, 10th Edition, 2017.

III B.Tech II Semester

ADVANCED MACHINE DESIGN

(PROFESSIONAL ELECTIVE - II)

L	T	P	C
3	0	0	3

PREREQUISITE: Design of Machine Members

COURSE OBJECTIVES:

- Understand the overview of different types of gears and their applications, force analysis, friction in worm gears etc.
- Understand different types of bearing and their design.
- Understand stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and T-section.

UNIT I

Spur gear design: Spur gears, Load concentration factor, Dynamic load factor-Surface compressive strength, Bending strength, Design analysis of spur gears, Estimation of centre Distance, Module and face width, check for plastic deformation. Check for dynamic and wear considerations.

UNIT II

Helical and bevel gear drives: Helical and Bevel gears, Load concentration factor, Dynamic load factor, Surface compressive strength, Bending strength, Design analysis of Helical and Bevel Gears, Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamics and wear Considerations.

UNIT III

Sliding contact bearings: Types of journal bearings, basic modes of Lubrication, Bearing construction–bearing design, bearing materials, selection of lubricants

Rolling contact bearings: Types of rolling contact bearings- selection of bearing type selection of bearing life, design for cyclic loads and speeds- Static and dynamic loading of ball & roller bearings.

UNIT IV

Curved Beams: Introduction to design, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c – clamps.

UNIT V

Design of power screws: Design of screw, Square, ACME, Buttress screws, design of nut, Compound screw, differential screw, ball screw – possible failures.

Design of worm gears: Worm gears, Properties of worm gears, Selection of materials, Strength and wear rating of worm gears, Force analysis, Friction in worm gears, thermal considerations.

UNIT VI

Tribology: Introduction to tribology**,** Tribology Principles, Principles for Selection of Bearing Types, generalized approach to hydrostatic bearing analysis, Gas Bearings,

Condition Monitoring and Failure Analysis: Installation Analysis, On-Line Monitoring, Oil Analysis, Wear Monitoring, Ball and Roller Bearing Failure Analysis, Oil-Film Bearing Failure Analysis.

COURSE OUTCOMES:

Students will be able to Understand and apply principles of gear design to spur gears and industrial spur gear boxes.

1. Become proficient in design of helical and bevel gear.
2. Develop capability to analyse rolling contact bearing & sliding contact bearing and its selection from manufacturer's catalogue in industrial applications.
3. Inculcate an ability to design curved beams by analysis.
4. Design of power screws and worm gears under strength and wear considerations.
5. Understand the significance of tribology and condition monitoring.

TEXT BOOKS:

1. Joseph E. Shigley, Mechanical Engineering Design, McGraw Hill, 7th Edition, 2016.
2. Pandya and Shah, Machine Design, Charotar, 20th Edition, 2015.

REFERENCE BOOKS:

1. V. B. Bandari, Machine Design, TMH Publishers, 5th Edition, 2020.
2. Timothy H, Wenzell, Machine Design, engage Learning, 1st Edition, 2004.
3. R.L.Norton, Machine Design, McGraw Hill, 5th Edition, 2013.
4. S. Md. Jalaludeen, Machine Design, Anuradha Publications, 2nd Edition, 2016.
5. Michael M. Khonsari&E. Richard Booser, Applied Tribology: Bearing Design and Lubrication, Wiley, 3rd Edition, 2017.
6. Gwidon W. Stachowiakand Andrew W. Batchelor, Engineering Tribology, Elsevier, 4th Edition, 2014.

DATA BOOKS:

1. Mahadevan, Design Data Book- P.S.G. College of Technology, CBS, 2020.
2. S.Md. Jalaudeen, Design Data Handbook, Anuradha Publications, 1stEdition, enlarged, 2016.

III B.Tech II Semester

MECHANICAL VIBRATIONS

(PROFESSIONAL ELECTIVE - II)

L	T	P	C
3	0	0	3

PREREQUISITE: Dynamics of Machines

COURSE OBJECTIVES:

- Introduce the knowledge about vibrations and their applications
- Propose the concept of single, double and multi degree freedom systems for un-damped and damped free vibrations
- Study different types of forced vibrations and vibration measuring instruments
- Formulate the differential equations of motion of vibratory systems.

UNIT I

Introduction Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonicforce, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

UNIT II

Un-damped (Single Degree of Freedom) Free Vibrations :Derivations for spring mass systems, Methodsof Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

UNIT III

Damped free vibrations (1DOF)

Types of damping, Analysis with viscous damping: Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

UNIT IV

Forced Vibrations (1DOF):Introduction, Analysis of forced vibration with constant harmonic excitation -magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

UNIT V

System with Multi degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Un-damped dynamic vibration absorber and Problems.

UNIT VI

Vibration Measuring Instruments and Whirling of shafts: Seismic InstrumentsVibrometers, Accelerometer, Frequency measuring instruments and Problems.Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

COURSE OUTCOMES:

At the end of course the students will be able to

1. Illustrate the causes of vibrations in industries and automobiles.
2. Apply principles of mechanical vibrations such as Newton's second law, and the principle of conservation of energy to the mathematical models to obtain their governing equations of motion.
3. Understand the causes and effects of vibration in mechanical systems. Understand the role of damping, stiffness and inertia in mechanical systems.
4. Analyse the vibrating systems and propose methods to reduce vibrations.
5. Solve vibration problems that contain multiple degrees of freedom.
6. Measure the parameters of vibrations in vibrating system.

TEXT BOOKS:

1. Groover G. K,MechanicalVibrations,Nem Chand and Bros,8th Edition,2018.
2. Meirovitch,Elements of Vibration Analysis, TMH,2nd Edition,2006.

REFERENCE BOOKS:

1. V.P. Singh, MechanicalVibrations, DanapathiRai& Sons, 4th Edition,2014.
2. SS Rao,Mechanical Vibrations,Pearson,6thEdition ,2018.
3. DebabrataNag, Mechanical Vibrations,Wiley,3rd Edition,2011.

III B.Tech II Semester

DESIGN THINKING & PRODUCT INNOVATION

(PROFESSIONAL ELECTIVE - II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide the basic concepts and techniques of engineering and reverse engineering, Process of design, analytical thinking and ideas, basics and development of engineering Drawing, application of engineering drawing with computer aide.
- To get exposure of exhibiting their creativity in terms of an innovative product development in a structured process through this course.

UNIT I

INTRODUCTION TO PRODUCT DESIGN AND DEVELOPMENT PROCESS

Characteristics of successful product development, design and development products, the challenges of product development, a generic development process, concept development the front end process, product development process flows, product development organisation. Product developing process.

UNIT II

IDEA AND CONCEPT GENERATION

Gather raw data from customer, interpret the raw data in terms of customer needs, organise the needs in to a hierarchy, establish the relative importance of the needs, reflects on the results and process, the activity of the concept generation, clarify the problem, search externally, search internally, explore systematically, reflect on the solutions and the process.

UNIT III

TESTING AND PRODUCT ARCHITECTURE DEVELOPMENT

Define the purpose of the concept test, choose a survey format, measure the customer response, Product architecture, architecture implementation and establishment, industrial design, impact of industrial design, industrial design process, management of the ID, assessing the quality of ID.

UNIT IV

DESIGN FOR MANUFACTURING AND PROTOTYPING

Define design for manufacturing, estimate the manufacturing cost, reduce the cost concepts, reduce the cost of the assembly, reduce the cost of the supporting production, and consider the impact of DFM, principles of prototyping, prototyping technologies, planning for prototypes.

UNIT V

ROBUST DESIGN

Introduction to robust design, identify the control factor, noise factors, performance matrices, objective function, run the experiment and conduct the analysis, reflect and repeat

UNIT VI

DESIGN THINKING FOR SERVICE DESIGN

Design thinking for service design: How to design a service, Principles of service design, Benefits of service design, Service blueprint, Design strategy, organization, principles for information design, principles of technology for service design.

COURSE OUTCOMES:

Upon the successful completion of the course, students will be able to

1. Gather deep insights into design thinking and appreciate various design process procedures.
2. Develop design ideas through different techniques and analyse innovative product design.
3. The knowledge gained through DFM and prototyping technologies can apply to make a prototype of models.
4. Understand how to design for robustness and conduct experiment with analysis.
5. Enhance the thinking for design of service with principles.

TEXT BOOKS:

1. Karl T Ulrich,Steven D Eppinger and Anita Goyal,Product Design &Development,Tata McGraw Hill,12th,2014.

2. Anthony Di Benedetto and Merle Crawford,New Products Management,Tata McGrawHill,11th,2014.

REFERENCE BOOKS:

1. Yousef Haik and Tamer M.Shahin, Engineering Design Process, Cengage Learning, 2nd Edition,2015.
2. Clayton Christensen,InnovatorsDilemma,Harper Collins Publishers,1st edition,2013.
3. John.R. Karsnitz,Stephen O'Brien and John P. Hutchinson,Engineering Design, Cengagelearning, second Edition, 2013.
4. Jimmy Jain,Design Thinking for start-ups,Notion Press,1st Edition,2018.
5. Michael Michalko, Thinker Toys, Ten Speed Press,2nd Edition,2006.
6. IdrisMootee, Design Thinking For Strategic Innovation, John Willey And Sons,1st edition,2013.

III Year II Semester

ROBOTICS

(PROFESSIONAL ELECTIVE - II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The general objectives of the course are to enable the students to

- Understand the components and their working principles of a robotic system.
- Expand this knowledge into the vast area of robotics.
- The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
- Mathematical approach to explain how the robotic arm motion can be described.
- The students will understand the functioning of sensors and actuators.

UNIT I

Robot Fundamentals: Definitions, History of robots, Laws of Robotics, Robot Specification, Anatomy of a Robot, An over view of Robotics: present and future applications , classification by coordinate system and control system.

UNIT II

Robot Components: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom: Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT III

Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates forward and inverse kinematics: problems.

UNIT IV

Manipulator Dynamics: Differential transformation of manipulators, Jacobians, problems, Dynamics:Lagrange Euler and Newton, Euler formulations: Problems.

UNIT V

Trajectory Planning: General considerations in path description and generation: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion, straight line motion

Robot Programming: languages and software packages-description of paths with a robot programming language.

UNIT VI

Robot Actuators And Feed Back Components:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors, potentiometers, resolvers, encoders, Velocity sensors.

Robot Applications In Manufacturing: Material Transfer: Material handling, loading and unloading, Processing: spot and continuous arc welding & spray painting: Assembly and Inspection.

COURSE OUTCOMES:

Upon successful completion of this course you should be able to

1. To learn about knowledge for the design of robotics.
2. Identify various robot configuration and components.
3. Carry out kinematic and dynamic analysis for simple serial kinematic chains
4. Calculate the Jacobian for serial and parallel robot.
5. Perform trajectory planning for a manipulator by avoiding obstacles and develop programming principles, languages for a robot control system
6. Select appropriate actuators and sensors for a robot based on specific application

TEXT BOOKS:

1. Groover M P, Industrial Robotics, Pearson,3rdEdition,2008.

2. Mittal R K &Nagrath IJ, Robotics and Control, TMH, 1st Edition, 2017

REFERENCE BOOKS:

1. Fu K S,Robotics ,McGraw Hill, Indian Edition, 1st Edition, 2017.

2. Richard D. Klafter, Robotic Engineering, Prentice Hall, 1stEdition, 2010.

3. John J Craig, Introduction to Robotics, Pearson Edu, 3rdEdition, 2004.

III B.Tech II Semester

SOLAR ENERGY SYSTEMS

(Open Elective-III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Develop research level programs for creating professional manpower in Solartechnology
- To understand appliances available in the market that promote solarusage.
- To join hands for a greenertomorrow.
- Provide innovative, flexible and regular education by using the teaching methodology and by applying modern communication technologies toeducation
- Ensure relevance of programs by updating courseregularly

UNIT I

Introduction

Solar Cell and its function, Solar Technologies, Solar Cell Parameters, Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters.

UNIT II

Solar cells

Introduction, principle of solar cell energy conversion, Solar Cell technologies Crystalline Cells: Mono- crystalline and poly – crystalline cells, Metallurgical Grade Si, Electronic Grade Si, wafer production, Mono – crystalline Si Ingots, Poly – crystalline Si Ingots, Si – wafers, Si – sheets, Solar grade Silicon Sun movement over the day, shadowing effects, Photovoltaic Cell. Advantages & disadvantages of photo-voltaic conversion.

UNIT III

Applications

Solar water Heater Principals of solar thermal systems, Technology's in solar water heating systems, salient features of solar water heating systems, Types of solar heating systems available

Solar cooking: benefits of solar cooking, advantages and disadvantages solar cooking, principals and application of solar cooking,

Power generation: Grid Connected Solar System, Benefits from the Grid Connected Solar System, Off-Grid solar power generation

UNIT IV

Technology involved in PV systems

Types of PV Installation, structure to mount solar modules, concept of On-Grid PV system and converters, Types of metering arrangements for On-Grid. Concept of Off-Grid systems, DC to DC power converter, DC to AC Converter, AC to DC Converter, Battery Charge controller, Maximum Power Point Tracking, Specification of Inverter and charger.

UNIT V

Earthing for Solar PV systems

Fundamental of Earthing system, objectives of Earthing, need for Earthing, Design of Earthing, types of Earthing, types of Earth Testers, Standards / regulations on Earthing, grounding equipments, Earthing for solar PV cells

UNIT VI

Environmental protection andcarboncredits

Global environmental concern - United Nations framework convention on climate change (UNFCC), protocol, clean development mechanism (CDM), benefits to developing countries, building a CDM project, Environmental impacts -Environmental degradation due to energy production andutilization

COURSE OUTCOMES:

At the end of the course, the student will be able,

1. To Understand Solar Cell and PV Module
2. To understand the solar cell technologies .
3. To know the solar energy applications.
4. To know the types of Solar PV Installation, On-Grid and Off-Grid PV systems.
5. To understand types and design of Earthing for solar PV Systems.
6. To know the environmental effects and carbon credits.

TEST BOOKS:

1. Chetan Singh Solanki, Solar Photovoltaic's: Fundamentals, Technologies And Applications, PHI Learning, 3rd Edition, 2015.
2. Mr Michael Boxwell, The Solar Electricity Handbook, Green stream Publishing, Rev. Edition, 2021.
3. David Infield , Leon Freris, Renewable Energy in Power Systems,Wiley Publications, 2nd Edition, 2019.

REFERENCE BOOKS:

1.Solar PV and Wind Energy Conversion Systems: An Introduction to Theory, Modelling with MATLAB/SIMULINK, and the Role of Soft Computing Techniques . Springer International Publishing. 1stEdition, 2016.
2. Rabindra Kumar Satpathy, VenkateswarluPamuru, Solar PV Power- Design, Manufacturing and Applications from Sand to Systems, Elsevier Science, academic press, 1stEdition, 2020.

III B.Tech II Semester

SOFT COMPUTING TECHNIQUES

(Open Elective-III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to get an idea on

- Artificial Intelligence, Various types of production systems, characteristics of production systems.
- Neural Networks, architecture, functions and various algorithms involved.
- Fuzzy Logic, Various fuzzy systems and their functions.
- Genetic algorithms, its applications and advances.

UNIT I

Soft Computing: Introduction to soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence: Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.

UNIT II

Neural Network: Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network.

UNIT III

Perceptron: Perceptron training algorithm, Linear separability ,Widrow& Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA.

UNIT IV

Counter propagation network: architecture , functioning & characteristics of counter Propagation network, Hop field/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications. Hopfield v/s Boltzman machine. Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Associative Memory.

UNIT V

Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions. Fuzzy rule base system : Fuzzy propositions, formation, decomposition & aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

UNIT VI

Genetic algorithm: Fundamental, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator ,Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

COURSE OUTCOMES:

By the end of the course the student should be able to

1. Learn about soft computing techniques and their applications
2. Analyze various neural network architectures
3. Understand perceptrons and counter propagation networks.
4. Define the fuzzy systems
5. Analyze the genetic algorithms and their applications.

TEXT BOOKS:

1. S.N. Sivanandam& S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.
2. S, Rajasekaran& G.A. VijayalakshmiPai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.

REFERENCES BOOKS:

1. N.K.Bose, Ping Liang, Neural Network fundamental with Graph,Algorithms & Applications, TMH, 1st Edition, 1998.
2. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, 1stEdition, 2009.
3. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012.

WEB REFERENCES:

www.myreaders.info/html/soft_computing.html

III B.Tech II Semester

INTERNET OF THINGS

(Open Elective-III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the terminology, technology and itsapplications
- To introduce the concept of M2M (machine to machine) with necessaryprotocols
- To introduce the Python Scripting Language which is used in many IoTdevices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoTdevices.

UNIT I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols,

UNIT II

Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle, Embedded Systems, IoT Levels and Templates,

UNIT III

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF,YANG-NETCONF, YANG, SNMPNETOPEER

UNIT IV

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib.

UNIT V

IoT Physical Devices and Endpoints - Introduction to Raspberry PI - Interfaces (serial, SPI, I2C). Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT VI

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communicationAPIs.Webserver–WebserverforIoT,CloudforIoT,Pythonwebapplication framework. Designing a RESTful webAPI

COURSE OUTCOMES:

1. Interpret the impact and challenges posed by IoT networks leading tonew architecturalmodels.
2. Compare and contrast the deployment of smart objects and the technologiesto connect them tonetwork.
3. Appraise the role of IoT protocols for efficient networkcommunication.
4. Elaborate the need for Data Analytics and Security inIoT.
5. Illustrate different sensor technologies for sensing real world entities and identifythe

applications of IoTinIndustry.

TEXT BOOKS:

1. ArshdeepBahga and VijayMadisetti, Internet of Things - A Hands-on approach, Universities Press, 1st Edition, 2015.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 1st Edition, 2014.

III B.TechII Semester

SOLID WASTE MANAGEMENT

(Open Elective-III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To get on broader understandings on various aspects of solid waste management
- To attain knowledge on Reuse & Recycling of Solid Waste
- To know the stages of transportation of solid Waste
- To know how to separate waste of different kinds.
- To know the process of treatment.

UNIT I

Introduction of Solid Waste Management:

Goals and Objectives Of Solid Waste Management, Classification Of Solid Waste, Factors Influencing Generation Of Solid Waste, Sampling And Characterization, Future Changes In Waste Composition, Major Legislation, Monitoring Responsibilities.

UNIT II

Basic Elements In Solid Waste Management:

Elements and Their Interrelationship, Principles of Solid Waste Management, Onsite Handling, Storage and Processing Of Solid Waste

Collection of Solid Waste:

Type and Methods of Waste Collection Systems, Analysis of Collection System, Optimization of Collection Routes, Alternative Techniques for Collection System.

UNIT III

Trasfer and Transport:

Need For Transfer Operation, Compaction of Solid Waste, Transport Means and Methods, Transfer Station Types and Design Requirements

UNIT IV

Separation and TransfromationOf Solid Waste:

Unit operations used for separation and transformation: shredding, materials separation and recovery, source reduction and waste minimization.

UNIT V

Processing and Treatment:

Processing of Solid Waste, Waste transformation through Combustion and Composting, Anaerobic Methods for Materials Recovery and Treatment, Energy Recovery, Biogas Generation and Cleaning, Incinerators.

UNIT VI

Disposal of Solid Waste:

Methods of Disposal, Landfills: Site Selection, Design and Operation, Drainage and Leachate Collection Systems, Designated Waste Landfill Remediation

COURSE OUTCOMES:

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

1. Design the collection systems of solid waste of a town.
2. Design treatment of municipal solid waste and landfill.
3. To know the criteria for selection of landfill.
4. To characterize the solid waste and design a composting facility.

TEXT BOOKS:

1. George Techobanoglous, Integrated Solid Waste Management, McGraw Hill Publication, 2nd Edition 1993
2. William A worrel, P AarueVesilind, Solid waste Engineering, Cengage Learning, 1st Edition, 2019.

REFERENCES:

1. Vesilind, P.A., Worrell, W., Reinhart, D.Solid Waste Engineering, Cenage learning, 2nd Edition,2004
2. Charles A. Wentz, Hazardous Waste Management, McGraw Hill Publication,2nd Edition,1995.

III B.Tech II Semester

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Humanities Elective-I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of the course is to create awareness about different economic business and accounting issues**.**

UNIT I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics, Scope of Managerial Economics and its relationship with other subjects, Concept of Demand, Types of Demand, Determinants of Demand, Demand schedule, Demand curve, Law of Demand and its limitations, Elasticity of Demand, Types of Elasticity of Demand and Measurement, Demand forecasting and Methods of forecasting.

UNIT II

Production and Cost Analysis: Concept of Production function, Cobb-Douglas Production function, Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination, Concepts of Returns to scale and Economies of scale, Different cost concepts: opportunity costs, explicit and implicit costs, Fixed costs, Variable Costs and Total costs, Cost, Volume, Profit analysis, Determination of Breakeven point(simple problems)Managerial significance and limitations of Breakeven point.

UNIT III

Introduction to Markets & Pricing Policies: Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly, Features, Price and Output Determination, Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing.

UNIT IV

Types of Business Organization and Business Cycles: Features and Evaluation of Sole Trader, Partnership, Joint Stock Company, State/Public Enterprises and their forms, Business Cycles : Meaning and Features, Phases of a Business Cycle.

UNIT V

Introduction to Accounting; Double Entry Systems, Personal account, Real account, Nominal account GAAP-Preparation of final accounts, Trading account, Profit and Loss account, Balance sheet simple problems, Ratio Analysis .

UNIT VI

Capital and Capital Budgeting : Meaning of Capital, Capital Budgeting, Traditional Methods (payback period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to

1. To adopt the Managerial Economic concepts for decision making and forward, planning.
2. To outline the different types of business organizations and provide a framework for analyzing money in its functions as a medium of exchange

TEXT BOOKS:

1.Dr. B. Kuberudu and Dr. T. V. Ramana, Managerial Economics & Financial Analysis, Himalaya PublishingHouse,3rdEdition,2020.

2. K.L.Maheswari, Managerial Economics, Sultan Chand,19thEdition,2018,

REFERENCE BOOKS:

1. Suma Damodaran: Managerial Economics, Oxford University press, 2ndEdition, 2010.

2. Vanitha Agarwal, Managerial Economics, Pearson Publications, 1stEdition, 2013.

3. Sanjay Dhameja, Financial Accounting for Managers, Pearson, 1stEdition, 2013.

III B.TechII Semester

LIFE SCIENCES FOR ENGINEERING
(Humanities Elective-I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Introduce the molecular basis of life.
- Provide the basis for classification of living organisms.
- Describe the transfer of genetic information.
- Introduce the techniques used for modification of living organisms.
- Describe the applications of biomaterials

UNIT I

Comparison of biological organisms with manmade systems, Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources ,molecular taxonomy.

Learning Outcomes: After completing this unit, the student will be able to

- summarize the basis of life
- distinguish prokaryotes from eukaryotes
- compare biological organisms and manmade systems
- classify organisms

UNIT II

Water, Biomolecules: sugars, starch and cellulose, Amino acids and proteins, lipids, Nucleotides and DNA/RNA, structure and functions of proteins and nucleic acids, hemoglobin, antibodies and enzymes, Industrial applications of enzymes, Fermentation and its industrial applications.

Learning Outcomes: After completing this unit, the student will be able to

- outline the importance of water
- explain the relationship between monomeric units and polymeric units
- explain the relationship between the structure and function of proteins
- interpret the relationship between the structure and function of nucleic acids
- summarize the applications of enzymes in industry
- explain the applications of fermentation in industry

UNIT III

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis, Human physiology, neurons, synaptic and neuromuscular junctions.

Learning Outcomes: After completing this unit, the student will be able to

- apply thermodynamic principles to biological systems
- explain the mechanism of respiration and photosynthesis
- summarize the principles of information transfer and processing in humans

UNIT IV

Mendel’s laws, gene mapping, Mitosis and Meiosis, Epistasis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

Learning Outcomes: After completing this unit, the student will be able to

- define Mendel's laws
- demonstrate the mapping of genes
- explain interactions among genes and their significance
- differentiate the mitosis and meiosis
- explain the medical importance of gene disorders
- Identify DNA as a genetic material in the molecular basis of information transfer

UNIT V

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

Learning Outcomes: After completing this unit, the student will be able to

- outline the principles of recombinant DNA technology
- appreciate the potential of recombinant DNA technology
- summarize the use of biological materials for diagnostic devises

UNIT VI

Biostatistics covering, Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies: Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data: Hypothesis testing and ANNOVA (single factor) (4 Lectures)

COURSE OUTCOMES:

After studying the course, the student will be able to:

1. explain catalytic properties of enzymes
2. summarize application of enzymes and fermentation in industry
3. identify DNA as a genetic material in the molecular basis of information transfer
4. apply thermodynamic principles to biological systems.
5. analyze biological processes at the reductionist level
6. appreciate the potential of recombinant DNA technology

TEXT BOOKS:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, Biology: A global approach, Pearson Education Ltd, First Edition, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press,1st edition, 2011.

REFERENCE BOOKS:

1. Alberts et.Al., the molecular biology of the cell, 6/e, Garland Science, 6th Edition, 2014.
2. E. E. Conn, P. K. Stum,G. Bruening and R. H. Doi,Outlines of Biochemistry, John Wiley and Sons,5th edition,2009.

III B.Tech II Semester

FOREIGN LANGUAGE

GRUNDSTUFE DEUTSCH

(Humanities Elective-I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

This course is designed to introduce German through a study of Language with special focus on the cultural aspects.

UNIT I

Begrüssung, Landeskunde, Alphabet, Personalpronomen, Verben- heissen, kommen,wohnen, lernen,Zahlen (1-100), W-Fragen, Aussagesätze, Nomen- Singular und Plural, der Artikel - Bestimmter- UnbestimmterArtikel)

Lernziel:

Sichvorstellen, GrundlegendesVerständnisvon Deutsch, Deutschland in Europa.

UNIT II

KonjugationderVerben(regelmässig /unregelmässig),dasJahr- Monate, Jahreszeitenund die Woche, Hobbys, Berufe, Artikel, Zahlen (Hundertbiseine Million), Ja-/Nein- Frage, Imperativmit, Sie.

Lernziel:

Sätzeschreiben, überHobbys, Berufeerzählen, usw.

UNIT III

Possessivpronomen, Negation, Kasus (Bestimmter- UnbestimmterArtikel) Trennbareverben, Modalverben, Uhrzeit, Präpositionen, Lebensmittel, Getränkeund Essen, Farben, Tiere

Lernziel :

SätzemitModalverben, VerwendungvonArtikel, AdjektivbeimVerb

UNIT IV

Übersetzung: (Deutsch – English / English – Deutsch)

Lernziel:

Die Übungvon Grammatik und Wortschatz

UNIT V

Leserverständnis. Mindmapmachen, Korrespondenz- Briefe und Email

Lernziel:

Übung der Sprache, Wortschatzbildung.

UNIT VI

Aufsätze :DieFamilie, Bundesländer in Deutschland, EinFest in Deutschland

Lernziel :

Aktiver, selbständigerGebrauch der Sprache

UNIT VII

Dialoge:

a)Gesprächemiteinem/einer Freund /Freundin.

b)GesprächebeimEinkaufen ; in einemSupermarkt ; in einerBuchhandlung ;

c)ineinemHotel - an der Rezeption ;einTerminbeimArzt.

d)EinTelefongespräch ;Einladung–Abendessen

UNIT VIII Contemporary issues/ Native speaker

COURSE OUTCOME:

1. fulfills interest in lifelong learningof languages
2. develops adaptive thinking and adaptability.
3. good working knowledge of communicating in German.
4. critical thinking and innovative skills

TEXT BOOKS :

1.Netzwerk Deutsch alsFremdsprache A1, Stefanie Dengler, Paul Rusch, Helen Schmtiz, Tanja Sieber, Klett-LangenscheidtVerlag, München , 1st Edition, 2015.

REFERENCE BOOKS:

1. Lagun, HartmutAufderstrasse, Jutta Müller, Thomas Storz, 2012.

2. Studio d A1, Hermann Funk, Christina Kuhn, CorneslenVerlag, Berlin :2010

3.DeutscheSprachlehrefürAusländer, Heinz Griesbach, Dora Schulz, 2013

4.TangramAktuell-I, Maria-Rosa, SchoenherrTil, Max HueberVerlag, Muenchen :2012

III B. Tech II Semester

CAD/CAM LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To impart the fundamental knowledge on using various Design and CNC tools like Solid works, AutoCAD, FANUC etc., for Engineering Simulation
- To know various fields of engineering where these tools can be effectively used to improve the output of a product.
- To impart knowledge on how these tools are used in Industries by solving some real time problems using these tools.

Note: Conduct any FOURTEEN exercises from the list given below:

1. **DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric representation of dimensioning and tolerances scanning and plotting. Study of script, DXE and IGES files. **(4-Exercises)**
2. **PART MODELING:** Generation of various 3D models through protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and boolean based modelling surface and assembly modelling. Study of various standard translators. Design simple components. **(4-Exercises)**
3. Study of various post processors used in NC Machines.
4. Development of NC code for free form and sculptured surfaces using CAM software.
5. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.
6. CNC programming for turned components using FANUC Controller **(4-Exercises)**
7. CNC programming for milled components using FANUC Controller **(4-Exercises)**

PACKAGES TO BE PROVIDED TO CATER TO DRAFTING, MODELLING & MACHINING FROM THE FOLLOWING:

- SOLIDWORKS
- FANUC
- Master CAM etc.

COURSE OUTCOMES:

Upon successful completion of this course student should be able to:

1. Execute steps required for modelling 3D objects by using protrusion, cut, sweep, extrude commands
2. Convert 3D solid models into 2D drawing-different views, sections
3. Use isometric views and dimensioning of part models
4. Able to Machine simple components on CNC turning machine
5. Able to Machine simple components on CNC milling machine
6. Able to use CAM software to generate NC code

III B. Tech. II - Semester

HEAT TRANSFER LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Illustrate basic heat transfer principles and test the thermal conductivity of a metal rod
- Evaluate overall heat transfer coefficient in case of composite wall and heat exchanger
- Analyze the efficiency and temperature distribution of a pin fin
- Compare the emissivity of black and grey body
- Estimate heat transfer coefficient in case of external flows

LIST OF EXPERIMENTS

Note: Conduct any TEN experiments from the list given below:

1. Determination of overall heat transfer co-efficient through a composite wall.
2. Determination of thermal conductivity of a metal rod.
3. To find out the efficiency and temperature distribution along the length of a pin-fin under free and forced convection.
4. Determination of heat transfer rate through a concentric sphere.
5. Determination of heat transfer coefficient in forced convection.
6. To determine the natural heat transfer coefficient ‘h’ from the surface of the tube in both vertical and horizontal position.
7. Determination of LMTD and effectiveness of the heat exchanger under parallel and counter flow arrangement.
8. Determine the emissivity of the non – black surface and compare with the black body.
9. Determination of Stefan Boltzmann constant for radiation heat transfer.
10. Determination of heat transfer rate in drop and film wise condensation.
11. Determination of critical heat flux.
12. Heat Pipe Demonstration Apparatus
13. To determine heat transfer coefficient and instantaneous heat transfer rate for transient heat conduction and draw the graph of temperature variation with time.
14. Compare the rate of heat transfer and find out the critical thickness of insulation of a given pipe.

ADDITIONAL EXPERIMENTS

1. To demonstrate the working of vapour compression refrigeration system and calculate its capacity and performance.
2. Determination of thermal conductivity of liquids and gases.

3. Determination of heat transfer rate in radiator using radiator test rig.
4. Determination of heat transfer rate in twisted tape inserted co-axial heat exchanger.

COURSE OUTCOMES:

Upon completion of course student able to

1. Perform steady state conduction experiments to estimate thermal conductivity of different materials for plane, cylindrical and spherical geometries.
2. Obtain variation of temperature along the length of the pin-fin under forced and free convection
3. Estimate the heat transfer coefficients in forced convection, free convection and correlate with the theoretical values.
4. Compare parallel and counter flow heat exchanger performance characteristics.
5. Estimate heat transfer coefficients in condensation, boiling and effectiveness of heat pipe
6. Test Emissivity, Stefan Boltzmann Constant and Critical Heat flux.

REFERENCE BOOK

1. C.P. Kothandaraman, Heat and Mass Transfer Data Book, New Age International Private Limited,9^{th} edition,2018.

III B. Tech. II - Semester

QUANTITATIVE APTITUDE-II

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

Enable the students to

- Know the concepts of partnership and their profit sharing at the end.
- Understand the concept of sets and relation between sets and Venn diagrams.
- Apply the concepts of measures of central tendency and dispersion.
- Know the concepts of Permutations & Combinations and their application in probability.
- Calculate ages of persons in a family using the given data.
- Understand the given data and interpret the required values.

UNIT I

Business & Partnership

Partnership in business, Working and Sleeping Partners, Division of Shares, Partnership Involved Time and Work problems.

UNIT II

Set Theory &Venn Diagrams

Basic Concepts of Sets, Operations on Sets, Venn Diagrams, Problems.

UNIT III

Statistics:

Basics of Statistics, Range, Mean, Median, Mode, Standard Deviation, Problems.

UNIT IV

Permutations & Combinations and Probability

Basic concepts of Permutations & Combinations, Selection with and without repetition, Circular Arrangements. Concepts of Probability, Various Events of Probability, Related Problems.

UNIT V

Ages

Ratio Based, Proportion Based, Equation Based, Average Based, Age Problems.

UNIT – VI :

Data Interpretation

Line & Bar Graphs, Pie Charts/Graphs, Table Based Problems.

COURSE OUTCOMES:

After completing this course, the students will be able to

1. Calculate the profit or remuneration received at the end using the ratio of investments or workmen ship.
2. Evaluate number of persons/objects belonging to a specified category using the concept of Venn diagram.
3. Measure the range, mean, median and mode of the given data, identify the extent of dispersion and interpret the data.
4. Compute various ways of selection or arrangement of persons /objects and predict the probability of doing so.
5. Deduce the ratios/ equations corresponding to ages of persons of a family and calculate the corresponding ages.
6. Analyze the given chart / table and interpret the results from the given data.

TEXT BOOKS:

1. Dr.R.S. Aggarwal, Quantitative Aptitude for competitive Examinations,Sultan Chand Publications,1st revised edition,2017.

REFERENCE BOOKS:

1. Arun Sharma, How to Prepare for Quantitative Aptitude for the CAT, Tata McGrawHillPublishing Company,8th Edition,2020.
2. Dinesh Khattar,The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Pearson India, 4th Edition, 2019.

III B.Tech II Semester

MINI PROJECT

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To develop skills to identify, define and solve industry-oriented problems.
- Work individually and in teams effectively and cohesively.
- Understand ethical principles and commitment to professional ethics.

Mini Project is an industry-oriented project mainly focused to make students interact and collaborate with department specific specialization. This mini project is to be taken up during the vacation after VI semester examination. However, the mini project and its report shall be evaluated along with the project work in VIII Semester. The industry oriented mini project shall be submitted in a report form and presented before the committee. The committee consists of an external examiner, Head of the Department, Supervisor, and the senior faculty members of the department. There shall be no internal marks for industry-oriented mini project.

COURSE OUTCOMES:

The student will be able to:

1. Analyze and apply current techniques and tools to solve a problem.
2. Function effectively as an individual and as a responsible member of a team.
3. Gain knowledge in technical report writing.
4. Engage in lifelong activity.
5. Define and analyze a problem to assess health, safety and legal issues.
6. Apply ethical principles.