Faculty of Engineering & Technology
KAKATIYA UNIVERSITY, WARANGAL-506 009
Department of Mechanical Engineering

B. Tech. (Mechanical) VI SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Lecture Hrs/ week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC3201ME	Metal Cutting Science &Unconventional Machining process	3	-	-	3	30	70	3
2	PC3202ME	Heat Transfer	3	1	-	4	30	70	4
3	PC3203ME	Refrigeration and Air conditioning	3	-	-	3	30	70	3
4	PE-II*	Professional Elective-II	3	-	-	3	30	70	3
5	OE-I*	Open Elective -I	3	-	-	3	30	70	3
6.	HS3208	Managerial Economics and Accountancy	3	-	-	3	30	70	3
PRACTICALS									
7.	PC3209ME	Metal Cutting science Lab	-	-	3	3	25	50	1.5
8.	PC3210ME	Thermal Engineering-II Lab	-	-	3	3	25	50	1.5
	PW3211ME	Summer Internship	-	-	-	-	-	-	-
		Total	18	1	6	25	230	520	22

*(PE-II) **PROFESSIONAL ELECTIVE COURSE-II**	
PE3204ME	Finite Element Analysis
PE3205ME	Fatigue, Creep and Fracture
PE3206ME	Theory of Elasticity

Note: Please refer annexure-I for open elective -I

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B. Tech. (ME) VI SEMISTER

PC3201ME

METAL CUTTING SCIENCE AND UNCONVENTIONAL MACHINING

Course code	PCC				
Category	Professional Core Course				
Course title	**Metal Cutting Science and Unconventional Machining**				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	3	-	-	3	External Marks = 70

Unit-I

Basic chip formation process. Tool geometry: Nomenclature of single point cutting tool by ASA,ORS and NRS. Geometry of drills, Milling cutters and broaches. Recommended Tool angles.
Chip formation: Types of chips, BUE, Chip breakers. Machining: Orthogonal and oblique cutting, Mechanics of Orthogonal Cutting: Merchant's analysis, Friction. Shear angle: Shear angle Solutions of Merchant and Lee & Shafer. Cutting tool materials: High carbon steel, HSS, Carbides, Ceramics, Coated carbides, Cermets, HPC, CBN & Diamond.

Unit-II

Measurement of Cutting Forces: Lathe tool dynamometers, Drilling, Milling and Grinding Dynamometers .Thermal aspects of metal cutting: Sources of heat and heat distribution, various methods of measurement of temperature, Cutting fluids and applications. Tool wear, Tool life & Machinability: Types of wear, mechanism of tool wear, Tool life & Machinability. Effects of process parameters on Tool life, Taylor's tool life equation. Economics of machining: Tool life for maximum production, minimum cost.

Unit-III

Ultrasonic Machining (USM):Process description, abrasive slurry, Abrasive materials and their characteristics. Functions of liquid medium in slurry .Types of Transducers ,effect of process parameters, applications and limitations.
Abrasive Jet Machining (AJM): Principle of operation, process details, process variables and their effect on MRR and accuracy. Equation for MRR. Advantages, disadvantages and applications.
Water Jet Machining (WJM): Schematic diagram , equipment used, advantages and applications.

Unit- IV

Electro Discharge Machining (EDM):Process description with schematic diagram, process parameters, functions and characteristics of dielectric medium, dielectric fluids, over cut and side taper Flushing, Mechanism of metal removal, crater volume, types of power supply circuits,mathematicalanalysisofmetalremovalrate(MRR),characteristicsofsparkerodedsurfaces,advantages,disadvantagesand applications, wire electro-discharge machining principles and description.
Electro-Chemical Machining(ECM):Schematic of the process, process parameters, function and characteristics of electrolyte, chemistry of the process. Equation for specific MRR and electrode feed rate, advantages, limitations and applications. Rotary Machining, Hot machining, high speed machining, description of each process, process parameters, advantages and applications.

Unit-V

Laser Beam Machining (LBM):Principle of Laser Beam production, materials used, thermal analysis of the process, process parameters, equations for power density and machining rate, advantages, limitations and applications.

Plasma Arc Machining (PAM): Equipment used, process description and parameters, types of plasma arc: Transferred arc and non-transferred arc and process applications.

Electron Beam Machining (EBM): Schematic of the process, process parameters, principle of production of Electron beam, equipment used, Advantages, disadvantages and applications.

Hybrid Machining Processes: Principle of Hybrid machining process; Classification of hybrid machining Processes; Ultrasonic assisted Electro-chemical machining; Electro-chemical Hybrid Machining Processes (ECHMP); Electro-chemical Grinding machining; Electro-chemical Discharge Machining; Electric Discharge Grinding and Abrasive Water Jet Machining

Suggested Reading:

1. David A. Stephenson, Johs S. Agapiou, "Metal Cutting Theory and Practice", CRC Press, 3rdEdition, 2016.
2. B.L. Juneja ,Shekhon G.S. and Seth Nitin, "Fundamentals of Metal Cutting & Machine tools", New Age Publishers, 2003.
3. A. Bhattacharyya, "Metal Cutting Theory and Practice", New Central Book Agency (P) Ltd., 2006.
4. AmitabhaGhosh and Ashok Kumar Mallik, "Manufacturing Science", Affiliated East-West Press Pvt. Ltd., 2ndEdition, 2010.
5. Winston A. Knight and Geoffrey Boothroyd, "Fundamentals of Metal Machining & Machine tools", CRC Press, 3rd Edition, 2005.
6. McGeough JA, "Advanced Methods of Machining", Chapman & Hall, 1988.
7. Pandey PC. and Shah H.S., "Modern Machining Process", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1980
8. Bhattacharya A., "New Technology", the Institution of Engineers, India, 1984.
9. Davies and Austin, "Developments in High Speed Metal Forming". The Machinery Publishing Co. Ltd., 1985
10. Mikell. P. Groover "Principles of Modern Manufacturing" Wiley India Pvt. Ltd., New Delhi, 2014.

Hassan Abdel-Gawad El-Hofy, Advanced Machining Processes, Nontraditional and Hybrid Machining Processes, McGraw Hill Publishing Co. Ltd.

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B. Tech. (ME) VI SEMISTER

PC3202ME

HEAT TRANSFER

Course code	PCC				
Category	Professional Core Course				
Course title	**Heat Transfer**				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	3	1	-	4	External Marks = 70

Unit-I

Heat transfer fundamentals: Basic heat transfer mechanisms (conduction, convection and radiation), Conduction: General conduction equation on plane wall, Cylinders and spheres.

One dimensional steady state conduction through plane walls, hollow cylinders and spheres with and without heat generation .Thermal resistance network, Boundary Conditions, Effect of variable thermal conductivity for one-dimensional steady-state conduction in a plane wall .The critical radius of insulation.

Unit-II

Fins: Heat transfer analysis of a body with negligible internal temperature gradients, fins efficiency and effectiveness.

Lumped system analysis within the body with negligible internal temperature gradients. Transient heat transfer analysis of an infinite slab with specified temperature and connective boundary conditions. Use of Grover &Heisler charts for solving problems of infinite slabs, cylinders, spheres.

Unit-III

Convection: Physical mechanism of convection, Buckingham pi-theorem and use of dimensional analysis in free and forced convection, Physical significance of different dimensionless numbers. Concept of velocity boundary layer, thermal boundary layer.

Reynolds analogy, Chilton-Colburn analogy for turbulent flow over flat surfaces. Calculation of heat transfer for flow over plates, cylinders and in pipes in free and forced convection using empirical formulae.

Unit-IV

Radiation: Absorptivity, Reflectivity, and Transmissivity, Concept of a blackbody, Emissivity, the Planck Distribution law, Wien's Displacement Law, Stefan-Boltzmann, Kirchhoff's Law. The View factor, View factor relations, View Factors between Infinitely Long Surfaces: The Crossed-Strings Method Radiation exchange between Opaque, Diffuse, Gray Surfaces in an enclosure: Blackbody radiation exchange, the two-surface enclosure, radiation shields.

Unit-V

Heat Exchangers: Heat exchanger types, overall heat transfer coefficient. Heat exchanger analysis: Use of the Log Mean Temperature Difference (Parallel-Flow, Counter-Flow), the Effectiveness–NTU Method. Heat Exchanger Design and Performance Calculations (LMTD, ε-NTU methods), Selection of heat exchangers.

Boiling: Pool boiling regimes, nucleate pool boiling, and critical heat flux for nucleate pool boiling, minimum heat flux.
Condensation: Physical Mechanisms, Laminar Film Condensation on a Vertical Plate, Turbulent Film Condensation, drop wise condensation.

Suggested Reading:

1. John H Lienhard IV, John H LienhardV,A"Heat Transfer" Textbook, Fifth Edition, Phlogiston Press, 2019.
2. Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt "Fundamentals of Heat and Mass Transfer", 8th Edition, John willey& Sons, 2018.
3. J.P. Holman, "Heat Transfer", Tenth Edition, McGraw Hill Companies Inc., 2010.
4. Yunus A Cengel, "Heat Transfer A Practical Approach", Second Edition, McGraw-Hill, 2002
5. James R. Welty, Charles Wicks, Robert Wilson, Gregory Rorrer, "Fundamentals of Momentum, Heat and Mass Transfer", 4th Edition, John Wiley and Sons Ltd, 2001

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B. Tech. (ME) VI SEMISTER

PC3203ME

REFRIGERATION AND AIR CONDITIONING

Course code	PCC				
Category	Professional Core Course				
Course title	**Refrigeration and Air conditioning**				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	3	-	-	3	External Marks = 70

Unit-I

Definition of Refrigeration & Air Conditioning: Necessity of refrigeration. Applications of refrigeration and air conditioning. Units of refrigeration. Refrigerants classification and desirable properties of refrigerants. Air refrigeration: Carnot refrigeration cycle and its limitation. Air refrigeration cycle operating on Brayton cycle and analysis. Aircraft refrigeration: Necessity. Advantages of using air cycles for aircraft refrigeration. Refrigeration systems for low and high speed aircrafts.

Unit-II

Vapour compression system: Simple vapour compression cycle: COP, representation of cycle on T- S, P-H and H-S diagrams. Actual vapour compression cycle. Effect of superheating and sub cooling– problems.

Vapour absorption refrigeration systems: Ammonia –water, Lithium Bromide – water systems. Improvements using analyzer and rectifier. Desirable properties of combinations. Electrolux refrigerator – It's working.

Unit-III

Steam jet refrigeration systems: Analysis using T-S and H-S diagrams. Quantity of motive steam required. Use of barometric and evaporative condensers. Limitations and advantages of steam jet systems.

Thermoelectric refrigeration systems: Seebeck effect, Peltier effect and Thompson effect. Analysis of the thermoelectric refrigeration systems using Peltier effect. Expression for COP. Criterion for selecting thermoelectric effects. Vortex tube refrigeration – principle and working.

Unit-IV

Psychrometric properties of air: Psychrometric chart and psychrometric processes and combination of processes. By pass factor. SHR and Room conditioning using SHR with and without recirculation .Design and classification of Air conditioning systems, RSHF, GSHF, ERSF. Human comfort and tolerances. ASHRAE comfort charts. Effective temperature.

Unit-V

Cryogenics: Limitations of single stage vapour compression systems applied to low temperature applications. Multistage compression and cascade systems for production of low temperature .Joule Thompson effect and coefficient. Inversion curve. Liquification of air using Linde and cloud systems. Liquification of hydrogen and helium. Application of cryogenics in metallurgy, cryobiology and cryosurgery.

Suggested Reading:

1. Arora& Domkundwar, " A Course in Refrigeration and Air conditioning", 8th Edition, Dhanpatrai & Co, 2008.
2. Roy J. Dossat, "Principles of Refrigeration", 5th edition, Pearson Education, 2001
3. R.S. Khurmi& J.K. Gupta, "Refrigeration and air conditioning", 5th revised edition, S Chand & Co, 2008.
4. ordon &Priester, "Principles of Refrigeration and Air Conditioning", Prentice Hall, India,1988 Arora C.P., "Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 1988.

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B. Tech. (ME) VI SEMISTER

PE3204ME

FINITE ELEMENT ANALYSIS

(Professional Elective-II)

Course code	PEC				
Category	Professional Elective Course				
Course title	**Finite Element Analysis**				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	2	1	-	3	External Marks = 70

Unit-I

Introduction: Introduction to Finite Element Method ,solution method using FEM, discretization ,Boundary conditions, load application, types of elements comparison, Stress and Equilibrium, Boundary conditions. Strain-Displacement relations. Stress-strain relations. Types of elements used. Convergence requirements and geometric isotropy. Local, natural and global coordinates.
One Dimensional problems :Finite element modeling, coordinates and shape functions.
Potential Energy approach: Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions. Quadratic shape functions.

Unit-II

Analysis of trusses and frames: Element stiffness matrix for a truss member. Analysis of plane truss with number of unknowns not exceeding two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node.
Analysis of Beams: Element stiffness matrix for two nodded, two degrees of freedom per node beam element.

Unit-III

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions.
Finite element modeling of Axisymmetirc solids subjected to Axisymmetric loading with triangular elements.

Unit-IV

Two dimensional four nodded isoperimetric elements and numerical integration.
Steady state heat transfer analysis: One dimensional analysis of a find and two dimensional analysis of thin plate. Analysis of uniform shaft subjected to torsion.

Unit-V

Dynamic Analysis: Formulation of finite element mode, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.
Time dependent field problems: Application to one dimensional heat flow in a rod. Finite element formation to three dimensional problems in stress analysis. Introduction to Finite Element Analysis Software.

Suggested Reading:

1. Tirupathi R. Chandraputla and Ashok, D. Belgundu" Introduction to Finite Elements in Engineering", Pearson Education, 2002, 3rd Edition.
2. Rao S.S., "The Finite Element Methods in Engineering", pergamonPress, 1989.
3. Segerlind, L.J. "Applied Finite Element Analysis", Wiley Publication, 1984.
4. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill Company, 1984.

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B. Tech. (ME) VI SEMISTER

PE3205ME
FATIGUE CREEP AND FRACTURE
(Professional Elective-II)

Course code	PEC				
Category	Professional Elective Course				
Course title	**Fatigue Creep and Fracture**				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	2	1	-	3	External Marks = 70

Unit I:

Design philosophy : Infinite life, Safe life, Fail safe and Damage tolerant design concepts.
Fatigue Design : Cyclic stress and stress reversals, Fatigue and progressive fracture, Endurance limit, Fatigue Tests : Cantilever and Beam type of Fatigue Tests, Axial Fatigue Tests. Influence of mean stress on fatigue : Gerber, Goodman and Soderberg's criteria. Effect of compressive cyclic stress on fatigue. Fatigue design formula for axial, bending, torsional and combined loading.

Unit II:

Fatigue controlling factors: Effect of frequency, Temperature, size, form, stress concentration factors, Notch, sensitivity & surface conditions, residual stresses. Improvement of fatigue strength by chemical/metallurgical processes such as nitriding, flame hardening, case carburizing. Fatigue strength enhancement by mechanical work : cold rolling, peening, shot peening.

Unit III:

Effect of environment : Corrosion Fatigue, Concept of cumulative fatigue damage
Fracture Mechanics : Ductile and brittle fracture Theoretical cohesive strength of metals, Griffith Theory of brittle Fracture, Oruron's modification to Griffith Theory.

Unit IV:

Modes of fracture :Mode-I, -II and -III, fatigue crack growth, Behavior of metals, Linear Elastic Fracture Mechanics (LEFM), Stress Intensity Factor(SIF), Stress field near the crack tip, Critical SIF and Fracture Toughness, Experimental determination of fracture toughness KIC , COD gauge sand standard ASTM Tests.
Strain Energy Release Rates (SERR), Elasto-Plastic Fracture Mechanics (EPFM), Plastic zone size and its evaluation, J-Integral Method.

Unit V:

Creep Analysis :Definition, Constant stress and constant, strain creep tests. Uniaxial creep tests : Baily's Power Law, Creep relaxation : strain hardening and time hardening creep relaxation. Introduction to Creep bending and deflection of simple problems.

Suggested Reading

1. George E. Dieter, Mechanical Metallurgy, - McGraw Hill, NY,1988
2. Joseph Marin,Mechanical Behaviour of Engg.Materials,-PrenticeHallofIndia,1966
3. Stephens, R.I. and Fuchs,H.O.,Metal Fatigue in Engg.,-Wiley, NY2001
4. Finnie, I. and Heller, W.R., Creep of Engg. Materials, - McGraw Hill BookCo.,1959
5. Prasant Kumar, Fracture Mechanics

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B. Tech. (ME) VI SEMISTER

PE3206ME

THEORY OF ELASTICITY

(Professional Elective-II)

Course code	PEC				
Category	Professional Elective Course				
Course title	**Theory of Elasticity**				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	2	1	-	3	External Marks = 70

Unit-I

Analysis of Stress: Stress tensor, Equilibrium equations in Cartesian coordinates, Two dimensional stress at a point and principal stresses. Three dimensional stress at a point and principal stresses. Stresses on an oblique plane in terms of principal stresses.

Unit-II

Analysis of Strain: Strains in terms of displacements in Cartesian coordinates, Equations of compatibility, Generalized Hook's Law and Lame's constants, Strain energy, Dilatational and distortional energy, St. Venant's principle.

Unit-III

Two dimensional problems: Plane stress, Plane strain problems: Stress function, Bi-harmonic equation, Equilibrium equations, Strain displacement relations and compatibility equations in polar coordinates, Stress concentration.

Unit-IV

Bending of straight beams and curved beams, stresses in curved beams, expression for radius of curvature of neutral axis for rectangular, circular, trapezoidal and T-sections .Design of crane Hook, C-clamp. Design of chain drives: Power rating of roller chains. Strength of roller chains. Torsion of shafts, Membrane analogy. Bending of plates.

Unit-V

Axi-symmetric problems, Thick walled cylinders subjected to internal and external pressures, Stresses in composite tubes, Rotating disks of uniform and variable thickness. General treatment of column stability problems.

Suggested Reading:

1. L.S. Srinath, "Advanced Mechanics of Solids", Tata McGraw Hill Publ. Co., 1970.
2. S. Timeshenko& J.N. Goodier, "Theory of Elasticity", Tata McGraw Hill, 1970.
3. A.C. Uguaral, "Advanced Strength and Theory of Elasticity", Elsevier Publication, 1965.
4. S. Singh, "Theory of Elasticity", Khanna Publishers, 1979.

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B. Tech. (ME) VI SEMISTER

HS3208

Managerial Economics and Accountancy

(Humanity Sciences)

Course code	HS				
Category	Humanity Sciences				
Course title	Managerial Economics and Accountancy				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	3	-	-	3	External Marks = 70

UNIT-I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

UNIT-II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium.

UNIT-III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly.

UNIT-IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems.

UNIT-V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.

Suggested Reading:

1. Mehta P.L., Managerial Economics - Analysis, Problems and Cases,Sulthan Chand & Sons Educational Publishers, 2011
2. Maheswari S.N., Introduction to Accountancy, Vikas Publishing House, 2005
3.Pandey I.M., Financial Management, Vikas Publishing House, 2009

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B. Tech. (ME) VI SEMISTER

PC3210ME
METAL CUTTING SCIENCE LAB

Course code	PCC				
Category	Professional Core Course				
Course title	Metal Cutting science Lab				
Scheme and Credits	L	T	P	Credits	Internal marks = 25
	-	-	3	1.5	External Marks = 50

List of Experiments:

1. Grinding of a single point cutting tool.
2. Determination of shear angle in turning process.
3. Determination of shear angle in shaping process.
4. Study of chip formation in machining Ferrous and Non-Ferrous materials.
5. Determination of average chip-tool interface temperature by natural work-
6. Tool thermocouple method.
7. Determination of cutting forces in turning operation using a lathe-tool dynamometer
8. Tool wear measurement
9. Demonstration of Machinability of Mild Steel using Abrasive Water Jet
10. Demonstration of wire cut EDM for making slots in Tool Industry

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B. Tech. (ME) VI SEMISTER

PC3211ME
THERMAL ENGINEERING-II LAB

Course code	PCC				
Category	Professional Core Course				
Course title	Thermal Engineering-II Lab				
Scheme and Credits	L	T	P	Credits	Internal marks = 25
	-	-	3	1.5	External Marks = 50

List of Experiments:

1. Thermal Conductivity of Insulating Powder.
2. Heat Transfer from vertical tube by Natural Convection.
3. Heat Transfer through pin fin by natural and forced convection.
4. Heat Transfer by forced convection.
5. Heat Transfer through composite walls.
6. Emissivity of test plate.
7. Heat Transfer through metal rod.
8. Parallel and counter flow heat exchangers.
9. Heat transfer through two slab gaurded apparatus.
10. Heat transfer through heat pipe.
11. Estimation of Stefan Boltzman's constant.
12. Calibration of thermocouple.
13. C.O.P. of vapor compression refrigeration system.
14. Performance of Vapor Absorption Refrigeration System.
15. Performance testing of window air-conditioner
16. Separating and throttling calorimeter

Any ten (10) experiments can be conducted

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B. Tech. (ME) VI SEMISTER

PW3211ME SUMMER INTERNSHIP

Course code	PW3211				
Category	Project Work				
Course title	Summer Internship				
Scheme and Credits	L	T	P	Credits	Internal marks = --
	-	-	-	-	External Marks = --

Course Objectives:

- To give an experience to the students in solving real life practical problems with all its constraints.
- To give an opportunity to integrate different aspects of learning with reference to real life problems.
- To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.
- Course Outcomes: Student will be
- Able to design/develop a small and simple product in hardware or software.
- Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
- Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
- Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from anMechanical Industry / R & D Organization / National Laboratory for a period of 8 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional are to be based on the performance of the student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

*Students have to undergo summer internship of 6 Weeks duration at the end of semester VI

Annexure

- ✓ Students can select any one of the following subjects as an Open elective subject.

Open Elective subjects offered from different department

Sl. No	Course Code	Name of the subject	Branch
1	OE3213EC	Microprocessor and Interfacing	ECE
2	OE3207CS	Fundamentals of Data Structures	CSE

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B. Tech. (MECH) VI SEMESTER

OPEN ELECTIVE-I

OE3113EC MICROPROCESSORS AND INTERFACING

Course code	OE3113EC				
Category	Open Elective Course				
Course title	**Microprocessors And Interfacing**				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	3	-	-	3	External Marks = 70

UNIT I
Evolution of microprocessors, 8085 microprocessor architecture, addressing modes and instruction sets. Basic assembly language programming, pin configuration, timing diagram of read and write operation.

UNIT II
8086 architecture-functional block diagram, register organization, memory segmentation, programming model, pins description in maximum mode and minimum mode, timing diagrams.

UNIT III
Instruction formats, addressing modes, classification of instruction set, assembler directives, macros, 8086 microprocessor assembly language programs: simple programs involving data transfer operation, arithmetic operation, logical operation, branch operation, machine control operation, string manipulations, stack and subroutine operations.

UNIT IV
8255 Programmable peripheral interface block diagram and various modes of operation. Interfacing of ADC, DAC, keyboard, seven segment display, stepper motor interfacing and 8254 (8253) programmable interval timers.

UNIT V
Interrupt structure of 8086, interfacing programmable interrupt controller 8259 and DMA Controller 8257 to 8086 microprocessor. Serial communication standards, RS 232 ,Serial data transfer schemes and block diagram of 8251 USART.

Suggested Readings:
1. Ramesh Gaonkar, "Microprocessor architecture, programming and applications with the 8085", Penram International Publication (India) Pvt. Ltd.
2. Douglas V. Hall, "Microprocessors and Interfacing", Tata McGraw Hill Publication.
3. Sivarama P. Dandamudi, "Introduction to Assembly Language Programing From 8086 to Pentium Processors", Springer Publication.
4. Walter A. Triebel and Avtar Singh, "The 8088 and 8086 Microprocessors: Programming, Interfacing Software, Hardware and Applications", Pearson Publication.
5. A. K. Ray and K. M. Bhurchandi, "Advance microprocessors and Peripherals" Tata McGraw Hill Publication.
6. Lyla B. Das, "The X86 Microprocessors, Architecture, Programming and Interfacing (8086 to Pentium)", Pearson Publication.

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B. Tech. (ECE) VI SEMESTER

OPEN ELECTIVE – I

OE3207CS FUNDAMENTALS OF DATA STRUCTURES

Course code	OE3207CS				
Category	Open Elective Course				
Course title	Fundamentals Of Data Structures				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	3	-	-	3	External Marks = 70

UNIT-I

Introduction: Introduction to data structure, types of data structures, revision of arrays, memory representation of arrays, operations on arrays, static versus dynamic memory allocation, pointers, self-referential Structure Time complexity.

UNIT-II

Stack-Queue (Linear Data structures): Definition of stack, operations on stack, implementation of stack. Applications of Stack.

UNIT-III

Definition of queue, operations on queue, implementation of queue using arrays
Applications of queue, Circular queue and priority queue.

UNIT-IV

Trees-Graphs (Nonlinear Data structures): definition of trees, Terminology on trees, binary tree, binary search tree and its operations, tree traversal techniques. Applications of Trees.

UNIT-V

Graph: definition, terminology on graphs, representation of graphs, graph traversal techniques, spanning tree, minimum cost spanning tree algorithms. Applications of Graphs.

Text Books:

1. Sahni Horowitz, "Fundamentals of data structures in C", Universities Press, second edition, 2008, ISBN No- 978-8173716058.
2. R Venkatesan,S Lovelyn Rose,"Data structures",Wiley, second edition, 2019, ISBN No-978-8126577149.

References:

1.Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", Careermonk Publications, 2016, ISBN-No: 978-8193245279.