

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in MECHANICAL ENGINEERING (MECHATRONICS)

III YEAR COURSE STRUCTURE AND SYLLABUS (R18)
Applicable From 2018-19 Admitted Batch

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MT501PC	Mechanical Measurements & Control Systems	3	0	0	3
2	MT502PC	CAD/CAM	3	0	0	3
3	ME501PC	Dynamics of Machinery	3	1	0	4
4	SM504MS	Business Economics & Financial Analysis	3	0	0	3
5	MT503PC	Manufacturing Process & Machine Tools	3	0	0	3
6	MT504PC	Principles of Machine Design	3	0	0	3
7	MT505PC	Manufacturing Process Lab	0	0	2	1
8	MT506PC	Machine Tools Lab	0	0	2	1
9	MT507PC	CAD/CAM & Instrumentation Control Systems Lab	0	0	2	1
10	*MC510	Intellectual Property Rights	3	0	0	0
Total Credits			21	1	6	22

III YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	ME604PC	Finite Element Methods	3	0	0	3
2	MT601PC	Microprocessors and Microcontrollers	3	0	0	3
3	MT602PC	Robotics and its Applications	3	0	0	3
4		Professional Elective - I	3	0	0	3
5		Open Elective - I	3	0	0	3
6	MT603PC	Motion Control Design	3	1	0	4
7	MT604PC	CNC & Robotics Lab and Motion Control Design Lab	0	0	2	1
8	EE606PC	Microprocessors and Microcontrollers Lab	0	0	2	1
9	EN608HS	Advanced Communication Skills Lab	0	0	2	1
10	*MC609	Environmental Science	3	0	0	0
Total Credits			21	1	6	22

***MC - Environmental Science – Should be Registered by Lateral Entry Students Only.**

Note: Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

Professional Elective - I

MT611PE	Analog and Digital IC Applications
ME611PE	Unconventional Machining Processes
MT613PE	Total Quality Management

MT501PC: MECHANICAL MEASUREMENTS AND CONTROL SYSTEMS**B.Tech. III Year MT - I Sem.****L T P C**
3 0 0 3**UNIT - I**

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification, and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization, and Photo electric transducers, Calibration procedures.

Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple –Pyrometers Temperature Indicators.

UNIT - II

Measurement Of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement

Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge. **Measurement Of Level:** Direct method – Indirect methods – capacitive, ultrasonic, Magnetic, cryogenic fuel level indicators – Bubbler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

UNIT - III

Measurement of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Non-contact type of tachometer

Measurement of Acceleration and Vibration: Different simple instruments-Principles of Seismic instruments – Vibrometers and accelerometers.

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

UNIT- IV

Measurement Of Humidity – Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter

Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT-V

Elements Of Control Systems: Introduction, Importance – Classification – Open and closed systems Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications & design by Ernest O. Doebelin, TMH.
2. Measurement systems: Applications & design by D.S Kumar

REFERENCE BOOKS:

1. Instrumentation, measurement & analysis by B. C. Nakra&K. K. Choudhary, TMH
2. Experimental Methods for Engineers /Holman
3. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
4. Mechanical Measurements / Sirohi and Radhakrishna/ New Age
5. Instrumentation & mechanical Measurements by A.K. Tayal, Galgotia Publications

MT502PC: CAD/CAM**B.Tech. III Year MT - I Sem.**

L	T	P	C
3	0	0	3

Pre-requisites: To learn the importance and use of computer in design and manufacture**Course objectives:** To provide an overview of how computers are being used in Design, development of manufacturing plans and manufacture. To understand the need for integration of CAD and CAM**Course Outcomes:** Understand geometric transformation techniques in CAD. Develop mathematical models to represent curves and surfaces. Model engineering components using solid modeling techniques. Develop programs for CNC to manufacture industrial components. To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.**UNIT – I**

Fundamentals of CAD/CAM, Automation, design process, Application of computers for design, Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD, Design workstation, Graphic terminal, CAD software- definition of system software and application software, CAD database and structure.

Geometric Modeling: 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, and definitions of cubic spline, Bezier, and B-spline.**UNIT- II**

Surface modeling: Algebraic and geometric form, Parametric space of surface, blending functions, parameterization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.**UNIT – III**

NC Control Production Systems: Numerical control, Elements of NC system, NC part programming: Methods of NC part programming, manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV

Group Technology: Part families, Parts classification, and coding. Production flow analysis, Machine cell design.

Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.**Computer aided manufacturing resource planning:** Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning.**UNIT – V**

Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

Computer aided quality control: Automated inspection- Off-line, On-line, contact, Non- contact; Coordinate measuring machines, Machine vision.**Computer Integrated Manufacturing:** CIM system, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM /Groover M.P./ Pearson education
2. CAD / CAM Theory and Practice/ Ibrahim Zeid/TMH

REFERENCE BOOKS:

1. CAD/CAM Principles and Applications/P.N. Rao/TMH
2. CAD/CAM Concepts and Applications/ Alavala/PHI
3. CAD / CAM / CIM/Radhakrishnan and Subramanian/ New Age
4. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson
5. Computer Numerical Control Concepts and programming/Warren S Seames/ Thomson.

ME501PC: DYNAMICS OF MACHINERY**B.Tech. III Year MT - I Sem.**

L	T	P	C
3	1	0	4

Pre-requisite: Kinematics of Machinery

Course Objectives: The objective is to introduce some of the components mainly used in IC Engines and make analysis of various forces involved. Subjects deals with topics like inertia forces in slider crank mechanism; IC Engine components & the analysis like governors is introduced. It also deals with balancing of rotating & reciprocating parts. Studies are made about balancing of multi cylinder engines, Radial engines etc. study of primary & secondary forces are considered while balancing. Finally they are introduced to the topic of vibrations. The study deals with linear, longitudinal, & torsional vibrations. The idea is to introduce the concept of natural frequency and the importance of resonance and critical speeds.

Course Outcome: the study of KOM & DOM are necessary to have an idea while designing the various machine members like shafts, bearings, gears, belts & chains and various I.C. Engine Components & Machine tool parts.

UNIT – I

Precession: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships.

Static and Dynamic Force Analysis: Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D'Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

UNIT – II

Turning Moment Diagram And Flywheels: Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram –fluctuation of energy – flywheels and their design - Inertia of connecting rod- inertia force in reciprocating engines – crank effort and torque diagrams.-.

UNIT – III

Friction: pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches.

Brakes And Dynamometers: Types of brakes: Simple block brake, band and block brake- internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT – IV

Governors: Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effort and power of the governors.

Balancing: Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of "V" and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – V

Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines /S. S. Rattan / McGraw-Hill.
2. Theory of Machines /Sadhu Singh/Pearson

REFERENCE BOOKS:

1. Theory of Machines and Mechanisms/Joseph E. Shigley /Oxford
2. Theory of Machines / Rao,J.S / New Age

SM504MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS**B.Tech. III Year MT - I Sem.**

L	T	P	C
3	0	0	3

Prerequisites: None

Course Objective: To learn the basic business types, impact of the economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcome: The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

UNIT – I: Introduction to Business and Economics

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT - II: Demand and Supply Analysis

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function and Law of Supply.

UNIT- III: Production, Cost, Market Structures & Pricing

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT - IV: Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT - V: Financial Analysis through Ratios: Concept of Ratio Analysis, Importance, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.

REFERENCES:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

MT503PC: MANUFACTURING PROCESS AND MACHINE TOOLS**B.Tech. III Year MT - I Sem.**

L	T	P	C
3	0	0	3

UNIT – I

Casting: Steps involved in making a casting - Its applications - Patterns and Types of patterns – Pattern allowances and their construction. Types of casting processes – Solidification of casting.

Welding: Classification of Welding Processes - Arc welding, – Resistance welding, Thermit welding, Electron Beam Welding and Laser Beam Welding. Inert Gas Welding, TIG Welding, MIG welding, soldering and Brazing.

UNIT – II

Forming: Hot working, cold working, strain hardening, recovery, recrystallisation, and grain growth, Comparison of properties of Cold and Hot worked parts, rolling fundamentals – theory of rolling, types of Rolling mills and products.

Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining –spinning – Types of presses and press tools.

UNIT – III

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion.

Forging Processes: Forging operations and principles – Forging methods

UNIT – IV

Machining: Mechanics of orthogonal cutting – Lathe: Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, coolants, Machinability – Tool materials. Principle of working, specification of lathe – types of lathe – works and tool holding devices, Taper turning, Thread turning. Turret and capstan lathe – Principal features of automatic lathes. Shaping, slotting, planning and drilling machines – Principles of working – Principal parts – specification, classification, and operations performed

UNIT – V

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – Geometry of milling cutters – methods of indexing – Accessories to milling machines.

Finishing Processes: Grinding fundamentals - theory of grinding – classification of grinding machines – cylindrical and surface grinding machine-Tool and cutter grinding machine

TEXT BOOKS:

1. Manufacturing Technology (Vol. 1 & Vol. 2) / P.N. Rao/TMH/2nd Edition

REFERENCE BOOKS:

1. Principles of Metal Castings /Rosenthal/TMH
2. A Course in Workshop Technology/B.S. Raghuvamshi /Dhanpatrai & Sons
3. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson Edu.
4. Principles of Machine Tools/ Bhattacharya A and Sen. G.C/ New Central Book Agency.
5. Elements of Work Shop Technology – Vol. II/ Hajra Choudry/ Media Promoters.
6. Fundamentals of Metal Machining and Machine Tools/ Geoffrey Boothroyd/ McGraw Hill

MT504PC: PRINCIPLES OF MACHINE DESIGN**B.Tech. III Year MT - I Sem.**

L	T	P	C
3	0	0	3

UNIT – I

Introduction: General considerations in the design of Engineering Materials and their properties – selection – Manufacturing consideration in design. Tolerances and fits – BIS codes of steels.

Stresses In Machine Members: Simple stresses – Complex Stresses – impact stress strain relations – Static theories of failure – factors of safety – Design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

Fatigue Loading: Stress concentration – Theoretical stress Concentration factor – Fatigue stress concentration factor notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Fatigue theories of failure Goodman and Soderberg's lines.

UNIT – II

Rivited and welded joints: Riveted Joints: Modes of failure of riveted joints-Strength equations – efficiency of riveted joints-Design of boiler joints – eccentricity loaded riveted joints. Welding Joints: Design of fillet welds-axial loads – Circular fillet welds-bending and torsion-eccentricity loaded joints.

Axially Loaded Joints and Shafts: Keys, cotters and knuckle joints: Design of Keys stresses in key-cottered joints-spigot and socket, sleeve and cotter, jib and cotter joints-knuckle joints. Design of shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts of complex loads- Shaft sizes – BIS code. Design of shafts for gear and belt drives

UNIT – III

Power Transmissions Systems, Pulleys: Transmission of power by Belt and Rope drives, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives, Materials, Chain drives

UNIT – IV

Spur & Helical Gear Drives: Spur gears & Helical gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur and helical gears – Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamic and wear considerations.

UNIT - V

Bearings: Types of 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

TEXT BOOKS:

1. Mechanical Engineering Design by Bahland Goel, Standard Publications
2. Design of Machine Elements by kulakarni – Mc Graw Hill - 3rd

REFERENCE BOOKS:

1. Machine design by timothy H. Wenzell PE, Cengage
2. Machine design by r.L. Norton, Mc Graw hill
3. Machine design by V. Bandari, TMH Publishers
4. Machine design – Pandya & shah.

MT505PC: MANUFACTURING PROCESS LAB

B.Tech. III Year MT - I Sem.

L T P C
0 0 2 1

Minimum of 10 Exercises need to be performed

I. Metal Casting Lab:

1. Pattern Design and making - for one casting
2. Sand properties testing - Exercise -for strengths, and permeability –1
3. Moulding Melting and Casting – 1 Exercise

II. Welding Lab:

1. ARC Welding Lap & Butt Joint – 2 Exercises
2. Spot Welding – 1 Exercise
3. TIG Welding – 1 Exercise
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

IV. Processing Of Plastics

1. Injection Moulding
2. Blow Moulding

MT506PC: MACHINE TOOLS LAB

B.Tech. III Year MT - I Sem.

L T P C
0 0 2 1

Course Objectives:

- To impart practical exposure to the Machine tools
- To conduct experiments and understand the working of the same.

Any 8 of the following experiments

List of Experiments:

1. Introduction of general-purpose machines -Lathe, drilling machine, Milling machine, Shaper Planing machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on –lathe machine
4. Drilling and Tapping
5. Shaping and Planning
6. Slotting
7. Milling
8. Cylindrical Surface Grinding
9. Grinding of Tool angles

MT507PC: CAD/CAM & INSTRUMENTATION & CONTROL SYSTEMS LAB**B.Tech. III Year MT - I Sem.**

L	T	P	C
0	0	2	1

Course Objectives: To be able to understand and handle design problems in a systematic manner. To be able to apply CAD in real life applications. To be understand the basic principles of different types of analysis.

Course Outcomes: To understand the analysis of various aspects in of manufacturing design.

Note: Conduct any five exercises from the following:

(A) CAD/CAM LAB:

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi symmetric components.

(B) INSTRUMENTATION AND CONTROL SYSTEMS LAB

Pre-requisites: Basic principles of Instrumentation and control systems

Course Outcomes: At the end of the course, the student will be able to Characterize and calibrate measuring devices. Identify and analyze errors in measurement. Analyze measured data using regression analysis. Calibration of Pressure Gauges, temperature, LVDT, capacitive transducer, rotameter.

Any 8 of the following experiments

1. Measurement and control of Pressure of a process using SCADA system.
2. Study and calibration of LVDT transducer for displacement measurement.
3. Measurement and control of level in a tank using capacitive transducer.
4. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
5. Measurement and control of temperature of a process using resistance temperature detector with SCADA.
6. Measurement and control of flow of a process using SCADA systems.
7. Study and use of a Seismic pickup for the measurement of vibration.
8. Calibration of capacitive transducer for angular displacement.
9. Study and calibration of Mcleod Gauge for low pressure measurement.

MC510: INTELLECTUAL PROPERTY RIGHTS*B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	0

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

ME604PC: FINITE ELEMENT METHODS**B.Tech. III Year MT - II Sem.**

L	T	P	C
3	0	0	3

Pre-requisites: Mechanics of Solids

Course Objective: The aim of the course is to provide the participants an overview on Finite Element Method, Material models, and Applications in Civil Engineering. At the end of the course, the participants are expected to have fair understanding of:

- Basics of Finite Element Analysis.
- Available material models for structural materials, soils and interfaces/joints.
- Modeling of engineering systems and Soil–Structure Interaction (SSI).
- Importance of interfaces and joints on the behavior of engineering systems.
- Implementation of material model in finite element method and applications

Course Outcomes: At the end of the course, the student will be able to, Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer. Formulate and solve problems in one dimensional structures including trusses, beams and frames. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems. ANSYS, ABAQUS, NASTRAN, etc.

UNIT – I

Introduction to Finite Element Methods: General Procedure – Engineering Applications – Stress and Equilibrium, Strain – Displacement relations. Stress – strain relations: Finite Elements: 1- Dimensional, 2 – Dimensional, 3-Dimensional & Interpolation Elements

One Dimensional Problems: 1-D Linear and 1-D Quadratic Elements - Finite element modeling, Coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT – II

Analysis of Trusses: Derivation of Stiffness Matrix for Plane Truss, Displacement of Stress Calculations.

Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node beam element, Load Vector, Deflection.

UNIT – III

Finite element modeling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Estimation of Load Vector, Stresses

Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. Two dimensional four noded Isoparametric elements and numerical integration.

UNIT – IV

Steady State Heat Transfer Analysis: one dimensional analysis of Slab, fin and two-dimensional analysis of thin plate.

UNIT – V

Dynamic Analysis: Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss and beam.

Finite element – formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation. techniques such as semi-automatic and fully Automatic use of softwares such as ANSYS, ABAQUS, NASTRAN using Hexahedral and Tetrahedral Elements.

TEXT BOOKS:

1. Finite Element Methods: Basic Concepts and applications/Alavala/PHI
2. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu /Pearson

REFERENCE BOOKS:

1. An Introduction to the Finite Element Method / J. N. Reddy/ Mc Graw Hill
2. Finite Element Analysis / SS Bhavikatti / New Age
3. Finite Element Method/ Dixit/Cengage

MT601PC: MICROPROCESSORS AND MICROCONTROLLERS**B.Tech. III Year MT - II Sem.**

L	T	P	C
3	0	0	3

Course Objectives:

1. To familiarize the architecture of microprocessors and micro controllers
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors

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

1. Understands the internal architecture, organization and assembly language programming of 8086 processors.
2. Understands the internal architecture, organization and assembly language programming of 8051/controllers
3. Understands the interfacing techniques to 8086 and 8051 based systems.
4. Understands the internal architecture of ARM processors and basic concepts of advanced ARM processors.

UNIT - I:

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT - II:

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

UNIT – III:

I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

UNIT – IV:

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V:

Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd

Edition 2006.

2. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

REFERENCE BOOKS:

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications - K. Uma Rao, Andhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP-L138 Experimenter, Donald Reay, WILEY 2012.

MT602PC: ROBOTICS AND ITS APPLICATIONS**B.Tech. III Year MT - II Sem.****L T P C**
3 0 0 3**UNIT - I****Introduction:** Automation and Robotics, CAD/CAM And Robotics -An over view of Robotics – present and future applications - classification by coordinate system and control systems.**Components of the Industrial Robotics:** End effectors-types, Mechanical grippers, and other types of grippers, comparison of Electric, Hydraulic and pneumatic types of locomotion devices.**UNIT - II****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 - III****Manipulator jacobians:** Differential transformation and manipulators, Jacobians — problems.**Dynamics:** Lagrange — Euler and Newton-Euler formulations — Problems.**UNIT - IV****Trajectory Planning:** Path planning and avoidance of obstacles, Slew motion, joint interpolated motion — straight line motion.**Programming Languages:** problems. Robot programming, languages and software packages**UNIT - V****Robot actuators and Feed-back components:** Actuators: Pneumatic, Hydraulic actuators, electric and stepper motors. Feedback components, position sensors – potentiometers, resolvers, encoders – Velocity sensors.**Robot Application in Manufacturing:** Material Transfer - Material handling, loading and unloading – processing – spot and continuous arc welding & spray painting – Assembly and Inspection**TEXT BOOKS:**

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robo Technology Fundamentals, James G. Karamas, CENGAGE Publications

REFERENCES:

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering, I Richard D. Klaftezi Prentice Hall.
3. Robot Analysis and intelligence / Asada and Slotine A Wiley Inter Science.
4. Robot Dynamics & Control/Mark W. Spong and M. Vidya Sagar I John Wiley & Sons (ASIA) Pvt. Ltd.
5. Robotics and Control I Mittal R K & Nagrath I J / TMH.

MT611PE: ANALOG AND DIGITAL IC APPLICATIONS (PE - I)

III Year B.Tech. MT II-Sem

L	T	P	C
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UNIT - I

Integrated Circuits: Classification, chip size and circuit complexity, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp DC and AC characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

Op-Amp Applications: Basic applications of Op-amp- instrumentation amplifier, V to I and I to V converters, Differentiators and Integrators, Comparators, Schmitt Trigger.

UNIT - II

Active Filters & Oscillators: Introduction, 1st order LPF, HPF filters. Band pass, Band reject and all pass filters. Oscillator types and principle of operation – RC phase shift and, Wien bridge oscillators. waveform generators – triangular, saw tooth, square wave generator

UNIT - III

Timers: Introduction to 555 timer, functional diagram, monostable and astable operations and applications.

D-A and A-D Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC. DAC and ADC specifications.

UNIT - IV

Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis& characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, IC interfacing- TTL driving CMOS & CMOS driving TTL .

Design using TTL-74XX & CMOS 40XX series, code converters, decoders, Demultiplexers, decoders & drives for LED & LCD display. Encoder, priority Encoder, multiplexers & their applications, Digital arithmetic circuits-parallel binary adder/subtractor circuits using 2's, Complement system. Digital comparator circuits.

UNIT - V

Sequential Circuits: Flip-flops & their conversions. Design of synchronous counters. Decade counter, shift registers & applications, familiarities with commonly available 74XX & CMOS 40XX series of IC counters.

Memories: ROM architecture, types & applications, RAM architecture, Static & Dynamic RAMs.

TEXT BOOKS:

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.
2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 1987.
3. Modern Digital electronics – R P Jain, TATA Mc McGraw Hill (p) Ltd, 3rd Ed., 2003.

REFERENCES:

1. Operational Amplifiers and Linear Integrated Circuits – R.F. Coughlin and Fredrick F. Driscoll, PHI, 1977.
2. Operational Amplifiers and Linear Integrated Circuits: Theory and Applications –Denton J. Daibey, TMH.
3. Design with Operational Amplifiers and Analog Integrated Circuits - Sergio Franco, McGraw Hill, 3rd Ed., 2002.
4. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005.

ME611PE: UNCONVENTIONAL MACHINING PROCESSES (PE – I)**B.Tech. III Year MT - II Sem.**

L	T	P	C
3	0	0	3

Course Overview: The objective of this course is to introduce the student to more advanced topics in the machining processes. To bring out the need for Unconventional Machining Processes which will overcome the difficulties associated with Traditional Machining.

Course Objectives:

- To teach the modeling technique for machining processes
- To teach interpretation of data for process selection
- To teach the mechanics and thermal issues associated with chip formation
- To teach the effects of tool geometry on machining force components and surface finish
- To teach the machining surface finish and material removal rate

Course Outcomes:

- Understand the basic techniques of Unconventional Machining processes modeling
- Estimate the material removal rate and cutting force, in an industrially useful manner, for Unconventional Machining processes.

UNIT – I

Introduction – Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process, parameters, economic considerations, applications and limitations, recent development.

UNIT - II

Abrasive Jet Machining, Water Jet Machining And Abrasive Water Jet Machining: Basic principles, equipment, process variable, and mechanics of metal removal, MRR, application and limitations.

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring processes, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate.

UNIT – III

Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT – IV

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT - V

Application of plasma for machining, metal removing mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining – principle - maskants - applications.

Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolyte machining.

TEXT BOOKS:

1. Advanced Machining Processes / VK Jain / Allied publishers
2. Modern Machining Processes - P. C. Pandey, H. S. Shan/ Mc Graw Hill

REFERENCE BOOKS:

1. Unconventional Manufacturing Processes/ Singh M.K/ New Age Publishers
2. Advanced Methods of Machining/ J.A. McGeough/ Springer International
3. Non-Traditional Manufacturing Processes/ Benedict G.F./ CRC Press

MT613PE: TOTAL QUALITY MANAGEMENT (PE - I)**B.Tech. III Year MT - II Sem.**

L	T	P	C
3	0	0	3

UNIT – I

Introduction, The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT -II

Customer Focus and Satisfaction: Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing.

UNIT- III

Organizing for TQM: The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, Ishikawa diagram, paneto diagram, Kepner & Tregoe Methodology.

UNIT- IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

UNIT -V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third-party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOK:

1. Total Quality Management / Joel E. Ross/Taylor and Franscis Limited
2. Total Quality Management/P. N. Mukherjee/PHI

REFERENCE BOOKS:

1. Beyond TQM / Robert L. Flood
2. Statistical Quality Control / E. L. Grant.
3. Total Quality Management: A Practical Approach/H. Lal
4. Quality Management/Kanishka Bedi/Oxford University Press/2011
5. Total Engineering Quality Management/Sunil Sharma/Macmillan

MT603PC: MOTION CONTROL DESIGN**B.Tech. III Year MT - II Sem.**

L	T	P	C
3	1	0	4

UNIT – I

Introduction to Mechatronics, Mechatronics key elements, Graphical representation, Mechatronics design process, approaches in Mechatronics, Objectives of Mechatronics, applications of Mechatronic Systems.

UNIT – II

Transmission mechanics – linear power transmission, lead screw, timing belt, conveyors, Rotary transmission - spur gears and planetary transmission. Motors – DC servo motors with encoded feedback – Brushless DC servo motors with Hall- effect sensor, Stepper motors – full step, half step, and microstep. AC induction motors and their applications.

UNIT – III

Control system in Motion control: programmable motion control, closed loop PID control – feed forward control system, fundamental concept for adaptive control and fuzzy logic systems. Programmable Logic Controller: Basic PLC Structures, Input / Output Processing, Ladder Programming, Latching and Internal relays, Sequencing, Timers and counters.

UNIT – IV

INDUSTRIAL HYDRAULICS: Introduction, Merits of Fluid power and its utility for increase in productivity, symbolic representation of hydraulic elements – Hydraulic control valves, Hydraulic cylinders, Hydraulic accessories, and various pumps used in hydraulic system, Hydraulic fluids, Hydraulic circuits using Hydraulic cylinders and other elements. Applications of Hydraulic systems.

UNIT – V

INDUSTRIAL PNEUMATICS: Introduction, Symbolic representations of Pneumatic elements, Compressors and air line installation, Pneumatic control valves, Pneumatic actuators, Pneumatic circuits using Pneumatic cylinders and other elements. Fluidics and fluid logic systems. Applications of Pneumatic systems.

TEXT BOOKS:

1. Introduction to Mechatronics and measurement Systems, Alciatore, 2009, 3e, TMH
2. Pneumatic systems - Principles and maintenance, SR Majumdar, TMH
3. Hydraulic systems – Principles and Maintenance, SR Majumdar, TMH

REFERENCE BOOKS:

1. Mechatronics system design – Devdas shetty & Richard A. Kolk, Thomson, 2007
2. Mechatronics – W. Bolten, Pearson, 2010
3. Principles of Machine Tools – Sen & Bhattacharya
4. Introduction to Mechatronics, Appu Kuttan KK, Oxford Universities Press
5. Mechatronic systems: Fundamentals, Isermann, Springer.

MT604PC: CNC & ROBOTICS LAB AND MOTION CONTROL DESIGN LAB**B.Tech. III Year MT - II Sem.**

L	T	P	C
0	0	2	1

CNC & ROBOTICS LAB**Note: Any Six from the following**

1. Study and operation of CNC lathe
2. Study and operation CNC milling machine
3. Preparation of testing of typical part programs on CNC Trainer.
4. Preparation of typical part programs on CNC milling machine.
5. Exercises using CAM software.
6. Part program generation through G and M Codes for turning, contouring, drilling, Reaming and Milling.
7. Development of tool path simulation by setting tool offsets for multi operations.
8. Machining of various Components by generation of CNC code by CAM Software
9. Robot Programming for a given path.

MOTION CONTROL DESIGN LAB**Note: Any Six from the following**

1. Study of the following equipment:
 - a. Flow Control Valves
 - b. Directional Control Valves
 - c. Pressure Control Valves
2. Circuits for reciprocating motion of a single acting and double acting pneumatic cylinders.
3. Circuits for reciprocating motion of hydraulic cylinders.
4. Circuits for speed control of a
 - (a) Single acting pneumatic cylinder.
 - (b) Double acting Pneumatic cylinder.
5. Circuits for semi automatic and automatic operation of a double acting Pneumatic cylinders.
6. Circuits for semi automatic and automatic operation of a double acting hydraulic cylinders.
7. Circuits for sequencing motion of two pneumatic cylinder using a sequence valve
8. Circuit for Measurement of pressure of oil in a hydraulic system.
9. Design and simulation of pneumatic circuits using simulation software
10. Design and simulation of hydraulic circuits using simulation software

EE606PC: MICROPROCESSORS AND MICROCONTROLLERS LAB

III Year B.Tech. MT II-Sem

L	T	P	C
0	0	2	1

Cycle 1: Using 8086 Processor Kits and/or Assembler (5 Weeks)

- Assembly Language Programs to 8086 to Perform
 1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
 2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

Cycle 2: Using 8051 Microcontroller Kit (6 weeks)

- Introduction to IDE
 1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
 2. Time delay Generation Using Timers of 8051.
 3. Serial Communication from / to 8051 to / from I/O devices.
 4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

Cycle 3: Interfacing I/O Devices to 8051(5 Weeks)

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8 bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals by A K Ray, Tata McGraw-Hill Education, 2006
2. The 8051 **Microcontrollers**: Architecture, Programming & Applications by Dr. K. Uma Rao, Andhe Pallavi, Pearson, 2009.

EN608HS: ADVANCED COMMUNICATION SKILLS LAB

III Year B.Tech. MT II-Sem

L	T	P	C
0	0	2	1

1. INTRODUCTION:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCES:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

***MC609: ENVIRONMENTAL SCIENCE**

III Year B.Tech. MT II-Sem

L	T	P	C
3	0	0	0

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures
- Understanding the environmental policies and regulations

Course Outcomes:

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT - III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT - V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-

economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.