COURSE STRUCTURE & DETAILED SYLLABUS

MECHANICAL ENGINEERING

B. TECH THIRD YEAR SECOND SEMESTER

(Applicable for the batches admitted from 2020-2021)

ACE

Engineering College

Ankushapur(V), Ghatkesar(M), Medchal Malkajgiri (Dist.), Telangana - 501 301.

(An Autonomous Institution, Affiliated to JNTUH ,Hyderabad)

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Ankushapur(V), Ghatkesar(M), Medchal Malkajgiri Dist - 501 301

(Autonomous)

B.TECH. THIRD YEAR SECOND SEMESTER

MECHANICAL ENGINEERING

COURSE STRUCTURE

III Year				II Semester			
S.No.	Course Type	Course Code	Course Title	Periods Per Week			Credits
				L	T	P	
1	PCC	ME601PC	Design of Machine Members-II	3	0	0	3
2	PCC	ME602PC	Heat Transfer	3	1	0	4
3	PCC	ME603PC	CAD & CAM	3	0	0	3
4	PCC	ME604PC	Finite Element Methods	3	0	0	3
5	PEC		Professional Elective – I	3	0	0	3
6	OEC		Open Elective – I	3	0	0	3
7	PCC	ME605PC	Heat Transfer Lab	0	0	2	1
8	PCC	ME606PC	CAD & CAM Lab	0	0	2	1
9	HSMC	EN608HS	Advanced English Communication Skills lab	0	0	2	1
10	*MC	MC107ES	Environmental Science	3	0	0	0
11	*MC	MC108	Business English	2	0	0	0
12	*MC	MC611EC	Artificial Intelligence	3	0	0	0
Total				**23**	**1**	**6**	**22**

Note: *MC = Satisfactory/Unsatisfactory

MC107ES - Environmental Science– Should be Registered by Lateral Entry Students Only. MC108 – Business English– Should be Registered by Lateral Entry Students Only.

***Open Elective** – Students should take Open Electives from List of Open Electives Offered by Other Departments/Branches Only.

ME601PC: DESIGN OF MACHINE MEMBERS – II

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ME601PC	**Core**	3	0	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Prerequisite: Study of engineering mechanics, design of machine members-I and theory of machines.

Course Objectives:

1. To gain knowledge about designing the commonly used important machine members such as bearings, engine parts, springs, belts, gears etc.
2. To design the components using the data available in design data books.
3. To design a power transmission system through belt, rope and chain drive to meet desired needs in engineering applications.
4. To impart design skills to the students to apply these skills for the problems in real life industrial applications.
5. Apply failure theories in evaluating strength of machine elements.

Course Outcomes:

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

1. Knowledge about journal bearing design using different empirical relations.
2. Estimation of life of rolling element bearings and their selection for given service conditions.
3. Acquaintance with design of the components as per the standard, recommended procedures which is essential in design and development of machinery in industry
4. Apply the design concepts to estimate the strength of the gear.
5. Select suitable belt drives and associated elements from manufacturers catalogues under given loading conditions

UNIT – I

Sliding contact bearings: Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design.

UNIT – II

Rolling contact bearings: Ball and roller bearings – Static load – dynamic load – equivalent radial load design and selection of ball & roller bearings.

UNIT – III

Engine Parts: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends –Pistons, Forces acting on piston – Construction, Design, and proportions of piston.

UNIT – IV

Mechanical Springs: Stresses and deflections of helical springs – Extension and compression springs Design of springs for fatigue loading – natural frequency of helical springs – Energy storage capacity helical torsion springs – Design of co-axial springs, Design of leaf springs.

Belts & Pulleys: Transmission of power by Belt and Rope Drives, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives.

UNIT – V

Gears: Spur gears & Helical gears- Brief introduction involving important concepts – Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for wear.

Textbooks:

1. Design of Machine Elements / Spotts/ Pearson.
2. Machine Design / Pandya & Shah / Charothar.

Reference Books:

1. Design of Machine Elements-II / Kannaiah / New Age.
2. Design of Machine Elements / Sharma and Purohit/PHI.
3. Design Data Book/ P.V. Ramana Murti & M. Vidyasagar/ B.S. Publications.
4. Design Data Handbook/ S. Md. Jalaludeen/ Anuradha Publishers.

ME602PC: HEAT TRANSFER

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME602PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Prerequisite: Thermodynamics

Course Objectives:

1. To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications.
2. To understand the mechanisms of heat transfer under steady and transient conditions.
3. To understand the concepts of heat transfer through extended surfaces.
4. To learn the thermal analysis and sizing of heat exchangers (Use of standard HMT data book permitted)
5. To Understand the fundamentals of heat transfer processes occurring in natural and engineered systems and apply analytic procedures, numerical tools and problem-solving abilities to heat transfer problems.

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

1. Understand the basic modes of heat transfer.
2. Compute one dimensional steady state heat transfer with and without heat generation.
3. Understand and analyze heat transfer through extended surfaces.
4. Understand one dimensional transient conduction heat transfer.
5. Understand concepts of continuity, momentum and energy equations.
6. Interpret and analyze forced and free convective heat transfer.
7. Understand the principles of boiling, condensation and radiation heat transfer.
8. Design of heat exchangers using LMTD and NTU methods.

UNIT – I

Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady, and periodic heat transfer – Initial and boundary conditions.

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders, and spheres-Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation.

UNIT – II

One Dimensional Steady State Conduction Heat Transfer: Variable Thermal conductivity – systems with heat sources or Heat Generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance

Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.

UNIT – III

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation-Buckingham Π Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations – Integral Method as approximate method -Application of Von Karman Integral Momentum Equation for flat plate with different velocity profiles.

Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

UNIT – IV

Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this – Use of empirical relations for Horizontal Pipe Flow and annulus flow.

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

UNIT – V:

Heat Transfer with Phase Change:

Boiling: – Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

Text Books:

1. Heat and Mass Transfer – Dixit /Mc Graw Hill.
2. Heat and Mass Transfer / Altamush Siddiqui/ Cengage.

Reference Books:

1. Essential Heat Transfer - Christopher A Long / Pearson.
2. Heat Transfer –Ghoshdastidar / Oxford.

ME603PC: CAD & CAM

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME603PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Prerequisite: To learn the importance and use of computer in design and manufacture.

Course Objectives:

1. To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.
2. To understand the need for integration of CAD and CAM.
3. To Develop programming and operating skills for computer numerical control (CNC) machines.
4. To Understand concept of Group Technology, FMS and CIM.
5. To Understand the fundamentals used to create and manipulate geometric models.

Course Outcomes:

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

1. Describe basic structure of CAD workstation, Memory types, input/output devices and display devices and computer graphics.
2. Acquire the knowledge of geometric modeling and Execute the steps required in CAD software for developing 2D and 3D models and perform transformations.
3. Explain the basic concepts of CNC programming and machining.
4. Illustrate Group Technology, CAQC and CIM concepts.
5. Write the CNC part programming.

UNIT – I

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

Geometric Modeling: Wire frame modeling, wire frame entities, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT – II

Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions, parametrization 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.

Textbooks:

1. CAD/CAM Concepts and Applications / Alavala / PHI.
2. CAD/CAM Principles and Applications / P. N. Rao / Mc Graw Hill.

Reference Books:

1. CAD/CAM/ Groover M.P/ Pearson.
2. CAD/CAM/CIM/ Radhakrishnan and Subramanian / New Age.

ME604PC: FINITE ELEMENT METHODS

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ME604PC	**Core**	3	0	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Prerequisite: Mechanics of Solids

Course Objectives:

1. To understand the basics of Finite Element Analysis.
2. To inspect available material models for structural materials, soils andinterfaces/joints.
3. To understand modeling of engineering systems and Soil–Structure Interaction (SSI).
4. To create importance of interfaces and joints on the behavior of engineering systems.
5. To create awareness implementation of material model in finite element method and applications.

Course Outcomes:

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

1. Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer.
2. Formulate and solve problems in one dimensional structure including trusses, beams and frames.
3. Formulate FE characteristic equations for two dimensional elements.
4. Analyze plain stress, plain strain, axi- symmetric and plate bending problems.
5. Evaluate eigen values and eigen vectors for stepped bar and beam, explain nonlinear geometric and material nonlinearity.

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.

Textbooks:

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.

ME611PE: UNCONVENTIONAL MACHINING PROCESSES (Professional Elective - I)

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME611PE	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Course Objectives:

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

Course Outcomes:

1. Understand the basic techniques of Unconventional Machining processes modeling.
2. Understand the need and applications of modern machining processes.
3. Estimate the material removal rate and cutting force, in an industrially useful manner, for Unconventional Machining processes.
4. Illustrate the chemical, electrical & mechanical machining process.
5. Develop the economic aspects of the different unconventional machining process.

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.

ME612PE: MACHINE TOOL DESIGN (Professional Elective – I)

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ME612PE	**Core**	3	0	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Prerequisites: Machine Design, Machine Tools and Metrology, Machining Science

Course Objectives: This course is designed to:

1. Implement the tool design process when designing tooling for the manufacturing of a product.
2. Apply Geometric Tolerancing principles in the designs of tooling.
3. Evaluate and select appropriate materials for tooling applications.
4. Design, develop and evaluate cutting tools and work holders for a manufactured product.
5. Design, develop and evaluate appropriate Gauging systems to define limits and specifications of a work piece during the manufacturing process.
6. Design, develop, and evaluate tooling for various joining processes.
7. Apply ANSI standards to tool design drawings and layouts.
8. Use CAD and conventional techniques in creating tooling drawings.

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

1. Understand basic motions involved in a machine tool, design machine tool structures, design and analyze systems for specified speeds and feeds, select subsystems for achieving high accuracy in machining.
2. Understand control strategies for machine tool operations and apply appropriate quality tests for quality assurance.
3. Ability enhancement for the design of various components of structures, guideways, spindles of machine tools.
4. Ability enhancement to adopt & implement the recent trends required as per the applications.

UNIT – I

Introduction to Machine Tool Drives and Mechanisms: Introduction to the course, Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission.

UNIT – II

Regulation of Speeds and Feeds: Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design.

UNIT – III

Design of Machine Tool Structures: Functions of Machine Tool Structures and their Requirements, Design for Strength, Design for Rigidity, Materials for Machine Tool Structures, Machine Tool Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriages.

UNIT – IV

Design of Guideways, Power Screws and Spindles: Functions and Types of Guideways, Design of Guideways, Design of Aerostatic Slideways, Design of Anti-Friction Guideways, Combination Guideways, Design of Power Screws.
Design of Spindles and Spindle Supports: Functions of Spindles and Requirements, Effect of Machine Tool Compliance on Machining Accuracy, Design of Spindles, Antifriction Bearings.

UNIT – V

Dynamics of Machine Tools: Machine Tool Elastic System, Static and Dynamic Stiffness Acceptance Tests.

Text Books:

1. Tool Design/ Donaldson/ Fifth Edition, McGraw Hill.
2. Principles of Machine Tools/ G.C. Sen and A. Bhattacharyya /New Central Book Agency.

Reference Books:

1. Design of Machine Tools / D. K Pal, S. K. Basu / Oxford.
2. Machine Tool Design and Numerical Control/ N.K. Mehta / Mc Graw Hill.
3. Metal Cutting and Tool Design/ Ranganath B.J./ Vikas Publishers.
4. Fundamentals of Tool Design/ ASTME, PHI.
5. Tooling Data/ Joshi P.H./ Wheeler Publishing.

ME613PE: PRODUCTION PLANNING AND CONTROL (Professional Elective – I)

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME613PE	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Prerequisites: Management Science & Productivity

Course Objectives:

1. Understand the importance of Production planning & control. Learning way of carrying out various functions so as to produce right product, right quantity at right time with minimum cost.
2. To provide the students with an understanding of the basics of elements of PPC and types of production systems.
3. To know the basic Techniques and their application which are used in project management and to grasp basic knowledge about Materials Management, inventory control and MRP.
4. To expose to Aggregate planning, its methods and Routing.
5. Gain knowledge in fundamental concepts in the field of standard Scheduling methods, Dispatching and follow up.

Course Outcomes:

1. Define and understand concepts of PPC and types of production systems
2. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.
3. State techniques and their methodology in project management, Material Management, inventory control and MRP and JIT.
4. Appreciate and distinguish the importance of Aggregate planning and its methods and know about Routing.
5. Differentiate the concepts of Scheduling methods, Dispatching and follow up.

UNIT – I

Introduction: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

Forecasting – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques. Measures of forecasting errors.

UNIT – II

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP

II, ERP, JIT Systems - Basic Treatment only. **Aggregate planning –** Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

UNIT – III

Line Balancing: Terminology, Methods of Line Balancing, RPW method, Largest Candidate method and Heuristic method.

Routing – Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

UNIT – IV

Scheduling –Definition – Scheduling Policies – types of scheduling methods – differences with loading -flow shop scheduling – job shop scheduling, line of balance (LOB) – objectives - steps involved.

UNIT – V

Dispatching: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

Follow up: definition – types of follow up – expediting – definition – expediting procedures-Applications of computers in planning and control.

Text Books:

1. Operations management – Heizer- Pearson.
2. Production and Operations Management / Ajay K Garg / Mc Graw Hill.

Reference Books:

1. Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.
2. Production Planning and Control- Jain & Jain – Khanna publications.

ME600OE: QUANTITATIVE ANALYSIS FOR BUSINESS DECISIONS (Open Elective – I)

B.Tech. III Year II Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ME600OE	Core	3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: NIL				Total Classes: 60		

Course Objectives:

1. Understand the problem, identifying decision variables, objective and constraints.
2. Formulation of Optimization Problem by constructing Objective Function and Constraints functions.
3. Learn to select appropriate Optimization Technique for the formulated Optimization Problem.
4. Understood the procedure involved in the selected Optimization Technique.
5. Solve the Optimization Model with the selected Optimization Technique.

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

1. Familiar with issues that would crop up in business.
2. Understanding the problem, identifying variables & constants, Formulation of optimization model and applying appropriate optimization technique.
3. Able to formulate Mathematical Model to resolve the issue.
4. Able to select technique for solving the formulated Mathematical Model.
5. Able to analyze the results obtained through the selected technique for implementation.

UNIT – I

Introduction and Linear Programming: Nature and Scope of O.R.–Analyzing and Defining the Problem, Developing A Model, Types of models, Typical Applications of Operations Research; Linear Programming: Graphical Method, Simplex Method; Solution methodology of Simplex algorithm, Artificial variables; Duality Principle, Definition of the Dual Problem, Primal - Dual Relationships.

UNIT – II

Transportation and Assignment Models: Definition and Application of the Transportation Model, Solution of the Transportation Problem, the Assignment Model, & Variants of assignment problems. Traveling Salesman Problem.

UNIT – III

Replacement Model: Replacement of Capital Cost items when money's worth is not considered, Replacement of Capital Cost items when money's worth is considered, Group replacement of low-cost items.

UNIT – IV

Game Theory and Decision Analysis: Introduction – Two Person Zero-Sum Games, Pure Strategies, Games with Saddle Point, Mixed strategies, Rules of Dominance, Solution Methods of Games without Saddle point – Algebraic, arithmetic methods. Decision Analysis: Introduction to Decision Theory, Steps In the Decision Making, the Different environments In Which Decisions Are Made, Criteria For Decision Making Under Risk and Uncertainty, The Expected Value Criterion With Continuously Distributed Random Variables, Decision Trees, Graphic Displays of the Decision Making Process.

UNIT – V

Queuing Theory and Simulation: Basic Elements of the Queuing Model, Poisson Arrivals and Exponential Service times; Different Queuing models with FCFS Queue discipline: Single service station and infinite population, Single service station and finite population, Multi service station models with infinite population. **Simulation**: Nature and Scope, Applications, Types of simulation, Role of Random Numbers, Inventory Example, Queuing Examples, Simulation Languages.

Text Books:

1. Operations Research: Theory and Applications/ J. K. Sharma: / Macmillan, 2008.
2. Operations Research/ Er. Prem Kumar Gupta & Dr. D. S. Hira / S. Chana, 2016.

Reference Books:

1. Introduction To Operations Research; Hillier/Lieberman/ TMH, 2008.
2. Render: Quantitative Analysis for Management, Pearson, 2009.
3. Quantitative Analysis for Business Decisions / Sridharabhat/ HPH, 2009.
4. Operations Research / R. Panneerselvam/ PHI, 2008.
5. Operations Research: An Introduction / Hamdy, A. Taha/ PHI, 2007.
6. Quantitative Techniques/ Selvaraj/ Excel, 2009.
7. Quantitative Techniques for Decision Making / Gupta and Khanna/ PHI, 2009.
8. Operations Research/ Ravindran, Phillips, Solberg/ Wiley, 2009.
9. Quantitative Methods for Business/ Anderson, Sweeney, Williams/ 10/e, Cengage, 2008.

ME605PC: HEAT TRANSFER LAB

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ME605PC	**Core**	-	-	2	1	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		

Prerequisite: *Thermodynamics*

Course Objectives:

1. To enable the student to apply conduction, convection and radiation heat transfer concepts to practical applications.
2. To define the fundamental concepts to students in the area of heat transfer and its applications.
3. To recognize the practical significance of various parameters those are involved in different modes of heat transfer.
4. Analyze different methods to calculate the heat transfer coefficient in various heat transfer problems.
5. To apply the knowledge of heat transfer in an effective manner for different applications.

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

1. Perform steady state conduction experiments to estimate thermal conductivity of different materials.
2. Perform transient heat conduction experiment.
3. Estimate heat transfer coefficients in forced convection, free convection, condensation and correlate with theoretical values.
4. Obtain variation of temperature along the length of the pin fin under forced and free convection.
5. Perform radiation experiments: Determine surface emissivity of a test plate and Stefan- Boltzmann's constant and compare with theoretical value.

List of Experiments: Minimum twelve experiments from the following:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere.
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin.
6. Experiment on Transient Heat Conduction.
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection.
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.

11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus.

ME606PC: CAD & CAM LAB

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ME606PC	**Core**	-	-	2	1	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		

Prerequisite: To give the exposure to usage of software tools for design and manufacturing. To acquire the skills needed to analyze and simulate engineering systems.

Course Objectives:

1. To make the students understand and interpret drawings of machine components
2. To prepare assembly drawings both manually and using standard CAD packages
3. To gain practical experience in handling 2D drafting and 3D modelling software systems.
4. To study the features of CNC Machine Tool.
5. To expose the students to different applications of simulation and analysis tools.

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

1. Recreate part drawings, sectional views and assembly drawings as per standards
2. Draw 3D and Assembly drawing using CAD software.
3. Demonstrating manual part programming with G and M codes using CAM.
4. Analyze the stress and strain induced in plates, brackets, beams and heat transfer problems.
5. Calculate the natural frequency and mode shape analysis of 2D components and beams.

List of Experiments: Note: conduct any TEN 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.
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 in 3D 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.
8. Development of process sheets for various components based on Tooling and Machines.
9. Development of manufacturing defects and tool management systems.

10. Study of various post processors used in NC Machines.
11. Development of NC code for free form and sculptured surfaces using CAM software.
12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.

EN608HS: ADVANCED COMMUNICATIONS SKILLS LAB

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
EN608HS	**HSMC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	2	1	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		

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.

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.

Reference Books:

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.

*MC107ES: ENVIRONMENTAL SCIENCE

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
MC107ES	**MC**	3	0	-	0	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

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: C**limate 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.

*MC108: BUSINESS ENGLISH

B.Tech. III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
MC108	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	0	-	0	30	70	100
Contact Classes: 30	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:30**		

Prerequisite: Knowledge of functional English, basics in grammar, understanding of LSRW skills

Course Objectives:

The course aims to illustrate the significance of communication in professional life and emphasize the need for continuous learning in the context of globalization.

Course Outcomes: Students should be able to

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately in formal and informal situations.
3. Communicate confidently in various contexts and different cultures.
4. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills to perform effectively in personal and professional contexts.

UNIT – I: COMMUNICATION

Reading: Goal of Reading, General Strategies for Reading Comprehension, Previewing, Predicting, Identifying the main Idea, Questioning, Making Inferences, Visualizing

Listening: A conversation on phone, Listening to a travel anecdote

Writing: Filling in an application form, Writing emails

Speaking: Breaking the Ice, JAM sessions

Vocabulary: Word Formation: Homophones, Homonyms, Homographs

UNIT – II: DEVELOPMENT AND TRAINING

Reading: Reading between the Lines, Reading and answering a quiz

Listening: Listening to an Interview on Radio, A conversation between colleagues

Writing: Letters- responding to an invitation, letter of enquiry, letter of apology

Speaking: Role Play: How to make decisions, Giving the summary of an article, Descriptions

Vocabulary: Synonyms and Antonyms, One-word substitutes

UNIT – III: CORPORATE CULTURE

Reading: Reading beyond the lines, An article on the power of customers' opinions online

Listening: Working in Teams, Talking about Meetings

Writing: A memo asking for suggestions, Minutes of the meetings

Speaking: Discussion- How to make work place more ecofriendly?

Vocabulary: Technical or business vocabulary, emails and website terms

UNIT – IV: BEING PERSUASIVE

Reading: Reading for Negative Facts, The art of agreeing and disagreeing

Listening: What makes people persuasive, People negotiating a sale at a trade fair

Writing: A survey report, Completing a business report

Speaking: Things that are important when making a presentation, short presentations

Vocabulary: Cohesive Devices or Linkers, Collocations

UNIT – V: THINKING GLOBALLY

Reading: Thinking outside the box, Reading and comparing two articles, Ways of using social media

Listening: Thinking Globally, Social Media and Customers, Netiquette

Writing: Mail for a Job application

Speaking: How to use social media for your professional enhancement

Vocabulary: Avoiding Clichés, Idioms and Phrases

Reference Books:

1. New International Business English Updated Edition Workbook, Cambridge University Press.
2. Swan, M. (2016). Practical English Usage. Oxford University Press.
3. Kumar, S and Lata, P.(2018). Communication Skills. Oxford University Press.
4. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
5. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
6. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.
7. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

Web References:

1. www.elt.oup.com/learning resources
2. www.cambridgeenglishonline.org
3. www.eslcafe.com

4. www.bbc.co.uk/worldservice/learningenglish
5. www.manythings.org

E-Text Books:

The secret to perfecting your grammar - Bloomsbury International

*MC611EC: ARTIFICIAL INTELLIGENCE

B.Tech. III Year II Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
MC611EC	MC	3	0	-	0	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives: To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

UNIT – I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents **Basic Search Strategies**: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT – II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem.

UNIT – III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non- monotonic Reasoning, Other Knowledge Representation Schemes

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks.

UNIT – IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT – V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

Text Books:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice- Hall, 2010.

Reference Books:

6. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.
7. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

Web References:

https://nptel.ac.in/courses/106/102/106102220/

E-Text Books:

https://cse.iitkgp.ac.in/~pallab/ai.slides/lec1.pdf
https://www.cet.edu.in/noticefiles/271_AI%20Lect%20Notes.pdf