

ME BOS

S.No	Category	Course Code	Course Title	BOS
1	ES	GR14A1012	Engineering Mechanics (Statics)	MECH
2	ES	GR14A1020	Engineering Mechanics (Dynamics)	MECH
3	ES	GR14A1023	Engineering Graphics	MECH
4	ES	GR14A1025	Engineering Workshop	MECH
5	ES	GR14A2019	Kinematics of Machinery	MECH
6	ES	GR14A2020	Mechanics of Solids	MECH
7	ES	GR14A2021	Engineering Thermodynamics	MECH
8	ES	GR14A2022	Material Science and Metallurgy	MECH
9	ES	GR14A2023	Machine Drawing Lab	MECH
10	ES	GR14A2024	Material Science and Metallurgy Lab	MECH
11	ES	GR14A2025	Mechanics of Solids Lab	MECH
12	ES	GR14A2027	Production Technology	MECH
13	ES	GR14A2028	Fluid Mechanics and Hydraulic Machinery	MECH
14	ES	GR14A2029	Internal Combustion Engines	MECH
15	ES	GR14A2030	Advanced Mechanics of Solids	MECH
16	ES	GR14A2031	Production Technology Lab	MECH
17	ES	GR14A2033	Fluid Mechanics and Hydraulic Machinery lab	MECH
18	ES	GR14A3026	Machine Design	MECH
19	ES	GR14A3027	Applied Thermodynamics	MECH
20	ES	GR14A3028	Dynamics of Machinery	MECH
21	ES	GR14A3029	Machine Tools	MECH
22	ES	GR14A3030	Thermal Engineering Lab	MECH
23	ES	GR14A3031	Machine Tools Lab	MECH
24	ES	GR14A3032	Design of Machine Members	MECH
25	ES	GR14A3033	Heat Transfer	MECH
26	ES	GR14A3034	Metrology and Surface Engineering	MECH
27	ES	GR14A3035	Industrial Management	MECH
28	ES	GR14A3036	Automobile Engineering	MECH
29	ES	GR14A3037	Mechatronics	MECH
30	ES	GR14A3038	Power Plant Engineering	MECH
31	ES	GR14A3039	Heat Transfer Lab	MECH
32	ES	GR14A3040	Metrology Lab	MECH
33	ES	GR14A4039	Basic Finite Element Methods	ME
34	ES	GR14A4040	CAD/CAM	ME
35	ES	GR14A4041	Operations Research	ME
36	ES	GR14A4042	Flexible Manufacturing System	ME
37	ES	GR14A4043	Robotics	ME
38	ES	GR14A4044	Instrumentation and Control Systems	ME
39	ES	GR14A4045	Unconventional Machining Processes	ME
40	ES	GR14A4046	Renewable Sources of Energy	ME
41	ES	GR14A4047	Computational Fluid Dynamics	ME
42	ES	GR14A4048	CAD/CAM Lab	ME

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43	ES	GR14A4049	Instrumentation and Control Systems Lab	ME
44	ES	GR14A4050	Production Drawing Practice	ME
45	ES	GR14A4051	Refrigeration and Air Conditioning	ME
46	ES	GR14A4052	Production Planning and Control	ME
47	ES	GR14A4053	Plant Layout and Material Handling	ME
48	ES	GR14A4054	Tribology	ME
49	ES	GR14A4055	Mechanical Vibrations	ME
50	ES	GR14A4056	Nuclear Power Plant	ME
51	ES	GR14A4057	Optimization Techniques	ME
52	ES	GR14A4058	CAM and Simulation Lab	ME

1. Engineering Mechanics (Statics)

Course Code: GR14A1012

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

1. Solve forces and moments for planar system problems
2. Evaluate basic equilibrium, friction problems
3. Distinguish between Centroid and Centre of Gravity
4. Differentiate between area moment of inertia and mass moment of inertia
5. Evaluate trusses by method of joints and method of sections
6. Analyze mass moment of Inertia and area moment of inertia
7. Solve virtual work problems

2. Engineering Mechanics (Dynamics)

Course Code: GR14A1020

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

1. Comprehend the basics of kinematics of a particle, rectilinear and curvilinear motion, kinetics of particles
2. Apply Newton laws, work and energy method for kinematics of a rigid body in plane motion.
3. Evaluate rotational motion about a fixed axis of rigid bodies.
4. Illustrate the concepts of kinetics of a rigid body in plane motion.
5. Solve various cases of impulse momentum basic problems.
6. Evaluate moving bodies using D'Alembert's principle
7. Analyze various cases for vibration in mechanical components

3. Engineering Graphics

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Course Code: GR14A1023

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

1. Demonstrate different types of lines, the use of different types of pencils and drafter to represent
2. Illustrate the basic drawing techniques, conic sections, cycloid curves, involutes and engineering
3. Comprehend the basic concept of principle of planes of projections in front view and top view.
4. Implement the orthographic projections of points, lines, planes and solids
5. Analyze the structure which was hypostatically designed ex: development of surfaces
6. Explain the logic to convert pictorial views to orthographic projections and orthographic projections.
7. Evaluate conversions of isometric views to orthographic views helps in inventing new machinery.

4. Engineering Workshop

Course Code: GR14A1025

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

1. Design and model different prototypes in the Carpentry trade such as Cross lap joint, Dove tail joint.
2. Demonstrate straight fit, V-fit by making models.
3. Construct various basic prototypes in the trade of tin smithy such as rectangular tray and open scoop etc.
4. Analyze to make in the trade of Tin Smithy such as Rectangular tray and Open Cylinder.
5. Apply various House Wiring techniques such as connecting one lamp with one switch.
6. Develop various basic house wiring techniques such as two lamps with one switch, connecting a Fluorescent tube, Series Wiring, Go down wiring
7. Demonstrate to develop various basic prototypes in the trade of Welding such as Lap joint, Lap Tee joint, Butt joint and Corner joint.

5. Kinematics of Machinery

Course Code: GR14A2019

Course Outcomes:

1. List out the common mechanisms, working principles and its applications which is used in machines.
2. Interpret mobility for different mechanisms and enumerate rigid links, types of links and types of joints in the mechanisms.
3. Explain Straight line motion mechanisms and its applications generally used in various machines.
4. Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective design.
5. Define Cam terminology, classifications of cam and follower, cam profiles, Introduction about cam design and its applications.

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6. Explain Gear mechanism classification and gear train analysis, gear standardization and law of gearing.
7. Design and fabrication of gear box design followed by the specification and standards.

6. Mechanics of Solids

Course Code: GR14A2020

Course Outcomes:

1. Recognize the importance of properties of materials for deciding the design criteria.
2. Estimate the stresses and strains in structural members and machine elements subjected to external loads.
3. Estimate the stresses and strains due to combined normal and shear loads.
4. Sketch the shear force and bending moment diagrams for the beams carrying transverse loads.
5. Ascertain physical behaviour of materials subjected to external loads.
6. Recommend the materials and physical dimensions according to maximum stresses and strains.
7. Interpret the results and design data.

7. Engineering Thermodynamics

Course Code: GR14A2020

Course Outcomes:

1. State and Apply basic laws of thermodynamics to various flow and non-flow Processes.
2. Calculate the change in Entropy, Heat transfer and Work done in Thermodynamic processes.
3. Differentiate between various energy conversion devices like heat engine, heat pump and Refrigerator.
4. Deduce the efficiencies of various Power cycles
5. Obtain the various thermodynamic properties from steam tables and Psychrometric charts
6. Assess the various Refrigeration cycles based on Coefficient Of Performance(C.O.P)
7. Convert mass basis analysis to volume basis analysis in gas mixtures and vice versa

8. Material Science and Metallurgy

Course Code: GR14A2022

Course Outcomes:

1. Relate crystal structures and relationship between different materials.
2. Relate the equilibrium transformation diagrams for various metals.
3. Utilize appropriate techniques in treating a metal with proper heat treatment

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operations.

4. Have knowledge on different types of ferrous and nonferrous metals.
5. Manufacture different products with composite materials.
6. Recommend a suitable material with its properties for a specified application.
7. Evaluate the behavior of material when it is subjected to heat treatment process.

9. Machine Drawing Lab

Course Code: GR14A2023

Course Outcomes:

1. Design and manufacturing technology by which the students are interpret the various part drawing and assembly drawing practices
2. Analyze the standardized worldwide drawings and the standards can be adopted suitably at any of the manufacturing industries
3. Ascertain all the essential drafting methodologies.
4. Analyze the drawings of Machine elements and assembled parts.
5. Construct a set of working drawings of a machine assembly including assembly drawings, detail drawings, bill of materials, revisions block, part specifications, and general notes
6. Creating knowledge about the various practices with regard to the dimensioning, sectioning and development of views
7. Explain the importance of the linking functional and visualization aspects in the preparation of the part drawings

10. Material Science and Metallurgy Lab

Course Code: GR14A2024

Course Outcomes:

1. Relate properties to microstructure.
2. Choose suitable metals and alloys for industrial applications.
3. Find out the hardness of various treated and untreated metals.
4. Tell the chemical composition of various ferrous and non ferrous metals.
5. Select a suitable heat treatment process for a material.
6. Evaluate the behavior of materials after it is heat treated.
7. Create moulds from various materials and determining all mechanical properties

11. Mechanics of Solids Lab

Course Code: GR14A2025

Course Outcomes:

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1. Conduct experiments, analyze and interpret experimental data to know the behavior of material.
2. Evaluate the behavior of ferrous and non-ferrous metals subjecting to Transverse loading, axial loading, Torsional and Bending loading by means of experiments.
3. Determine the hardness and impact energy for different materials.
4. Determine and to understand the compressive strength of concrete cubes and blocks.
5. Calculate and analyze the stiffness of open coiled springs.
6. Determine the behavior of deflection of beams through deformation and to evaluate the modulus of elasticity of the given material.
7. Determine and analyze the torsional rigidity of different ferrous materials.

12. Production Technology

Course Code: GR14A2027

Course Outcomes:

1. Interpret contemporary developments in the field of manufacturing processes
2. Impart knowledge on role and value of production and identify basic production processes.
3. Introduction to methods of joining that shows a comprehensive understanding of tools, materials, equipment, and processes.
4. Demonstrate awareness of the competition that surrounds the development of inventions and the control of welding processes
5. 5 Apply critical thinking skills for development and evaluating ideas for manufacturing processes.
6. Identify and use the materials, tools, machines, and techniques used in various forming processes.
7. Demonstrate various ways of producing plastic products and its equipment details.

13. Fluid Mechanics and Hydraulic Machinery

Course Code: GR14A2028

Course Outcomes:

1. Use the governing equations of fluid flow and applying them to simple flow problems.
2. Explain the mathematical formulation of various flow problems.
3. Analyze the boundary layer concept to the fluid flow problems.
4. Apply the concept of fluid and models of fluids for flow problems.
5. Explain the stream function and potential function to fluid flow problems.
6. Apply the basic principles to derive the equation for viscous flow
7. Distinguish laminar flow & turbulent flow.

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14. Internal Combustion Engines

Course Code: GR14A2029

Course Outcomes:

1. Describe and assess benefits of improvements to thermodynamic systems
2. Describe and apply basic thermodynamic principles and laws of physics to analysing and predicting performance of idealised forms of thermodynamic systems
3. To improve the analytical skills in finding the engineering solutions and redesign the system to improve the fuel efficiency of the engine in global, environmental and social contexts.
4. To adopt the resources available at optimum level in order to achieve the better efficiency in the performance of different types of Air compressors duly reducing the operational losses.
5. To develop an idea of utilization of resources duly reducing the emission levels for achieving eco-friendly environment.
6. To have knowledge to redesign the different components of air compressors depending upon the type of applications for global economic and environmental context within realistic constraints like health, safety and sustainability.
7. To impart the knowledge of many different aspects of engineering, including mechanical engineering, combustion, electrical and electronic systems and fuel technology.

15. Advanced Mechanics of Solids

Course Code: GR14A2030

Course Outcomes:

1. Calculate the stresses in non-uniform structural beams
2. Estimate the safe pressure that can be carried by thin and thick pressure shells pressure vessels
3. Select suitable column or a struts for particular application
4. Compute the stresses in indeterminate structural members
5. Distinguish bucking stresses from axial compressive stresses
6. interpret and identify suitable material for corresponding stresses
7. Analyze structures and calculate the stresses under combined loading.

16. Production Technology Lab

Course Code: GR14A2031

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Course Outcomes:

1. Produce quality of products from casting process.
2. Execute a layout of shop floor for different applications.
3. Apply creativity in making various products using sheet metal operations.
4. Find, analyze and solve technical problem when manufacturing a component.
5. Prepare products from various plastic molding processes.
6. Work with all machineries and prepare errorless products.
7. Recognize the importance of safety devices and equipments to be wearred before doing an operation.

17. Fluid Mechanics and Hydraulic Machinery lab

Course Code: GR14A2033

Course Outcomes:

1. Asses the friction factor using major and minor losses in pipes
 2. Examine the coefficient of discharge of venturimeter and orifice meter
 3. Prove the Bernoulli's equation.
 4. Recommend the type of pump for a particular application
 5. Calculate the efficiencies of various turbines
 6. Determine the coefficient of impact of various jets using various vanes
 7. Determine the overall efficiencies of various pumps
- List of Experiments

18. Machine Design

Course Code: GR14A3026

Course Outcomes:

1. Outline all the properties of the materials. Estimate the tolerances and fits of shaft-hole basis system.
2. Compute the dimensions of the members subjected to bi-axial loading using theories of failure.
3. Design the machine members subjected to simple fatigue loading and bi-axial fatigue loading.
4. Apply different methods to the design of shafts subject to combined static and variable loads.
5. Solve the dimensions of the riveted, welded and bolted joints subjected different loading.
6. Design of keys, cotters and knuckle joints subjected to tensile and compressive loading.
7. Compute the dimensions of the shafts and shaft couplings subjected to torsional loading, combined tensional and bending loading

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19. Applied Thermodynamics

Course Code: GR14A3026

Course Outcomes:

1. Illustrate the power generation through Rankine cycle and able to explain efficiency enhancement methods of Reheating and regeneration.
2. Classify the different types of boilers and can distinguish mountings and accessories and know the types of draughts and its application in the steam generator.
3. Distinguish the ideal flow and actual flow through nozzle and able to entail the concept of Critical pressure ratio in calculations and meta-stable flow/ super saturation flow through nozzle.
4. Differentiate the working of impulse and reaction turbines and construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine. Student can know why to reduce the rotor speed and methods to reduce.
5. Focus on the basic components of a gas turbine power plant and can illustrate the power generation using Joule Cycle and methods to increase the specific power output and efficiency of the cycle.
6. Compare the working of various propulsive devices and can have awareness of using thrust equations in solving problems.
7. Analyze the design parameters of the components of the plant for better performance duly minimizing the operating losses.

20. Dynamics of Machinery

Course Code: GR14A3028

Course Outcomes:

1. Analyse complete motion analysis of machines in running condition.
2. Students can be able to know friction and its effect on mechanical efficiency.
3. Explain how to balance forces and moments produced by rotating or reciprocating masses of machine members.
4. Design various mechanisms of machines which were used in real life.
5. Explain how to get equilibrium condition of machine members while the machine is in running condition.
6. Analyze the vibrations, which is the major disturbance in machines while in the running condition and also precautions to reduce vibration.
7. Apply the knowledge regarding use of turning moment diagram and energy fluctuations with in systems.

21. Machine Tools

Course Code: GR14A3029

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Course Outcomes:

1. Explain the importance of tool geometry in manufacturing the component.
2. Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses and cutting machines
3. Perform cutting force analysis of metal cutting machines.
4. Perform chip formation analysis of metal cutting machines
5. Execute the gear cutting and finishing process on various machines
6. Perform economics of machining and tool life estimation
7. Apply safety principles in a work environment to minimize hazards and prevent losses to productivity

22. Thermal Engineering Lab

Course Code: GR14A3030

Course Outcomes:

1. Explain the complete operation of 2 stroke and 4 stroke I.C engines which can be further confirmed through valve timing diagram and port timing diagram
2. Explain the performance of 2-S and 4-S engines and the variation of various performance parameters with load and speed.
3. Evaluate the heat balance of the engine cylinder after the combustion process.
4. Analyse the working and performance evaluation of mechanical power consuming devices like compressors.
5. Study the variation of performance of the engine with compression ratio in variable compression ratio S.I engine
6. Determine the friction power of the multi cylinder engine
7. Determine Performance of multi cylinder petrol engine and estimate the firing order of it.

23. Machine Tools Lab

Course Code: GR14A3031

Course Outcomes:

1. Apply tool geometry in manufacturing the component.
2. Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses and cutting machines
3. Perform cutting force analysis of metal cutting machines.
4. Perform chip formation analysis of metal cutting machines
5. Execute the gear cutting and finishing process on various machines
6. Perform economics of machining and tool life estimation
7. Apply safety principles in a work environment to minimize hazards and prevent losses to productivity

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24. Design of Machine Members

Course Code: GR14A3032

Course Outcomes:

1. Design of Journal bearings subjected to static and dynamic loading.
2. Compute the dimensions of I.C engine reciprocating parts subjected to variable loads.
3. Solve the dimensions of I.C engine rotary parts subjected to variable loads.
4. Apply different methods to the design of different springs subject to shock loading.
5. Design of spur and helical gears subjected to static and dynamic loading.
6. Compute the dimensions of the power screws considering various types of loads.
7. Make proper assumptions and perform correct analysis while designing the various machine elements for industrial applications.

25. Heat Transfer

Course Code: GR14A3033

Course Outcomes:

1. Discuss the various modes and mechanisms of heat transfer
2. Explain the general heat conduction equation in cartesian, cylindrical and spherical systems.
3. Solve steady state heat conduction problems in slabs, cylinders, spheres
4. Derive the heat transfer equations in fins.
5. Calculate the heat transfer coefficients in free and forced convection heat transfer
6. Compute the rate of heat transfer in heat exchangers
7. Classify the various types of radiation emitting, receiving and transmitting bodies

26. Metrology and Surface Engineering

Course Code: GR14A3034

Course Outcomes:

1. Able to use different linear and angular measuring instruments,
2. Able to apply different measuring instruments in real time for quality inspection.
3. Have solid foundation to train in high quality management system in their professional carrier.
4. Able to analyze different aspect of surface roughness tester, talysurf in real time environment.

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5. Explain the appropriate method for determination of accuracy based on product function and manufacturing capability.
6. Analyze the Measurements and dimensions of shafts, bearings and linear surfaces in metric and imperial units using callipers, micrometers, and scales.
7. Analyze the effective methods of measuring systems for straightness, flatness, roundness, profile, screw threads and gear teeth.

27. Industrial Management

Course Code: GR14A3035

Course Outcomes:

1. Apply theories and course concepts to properly analyze and diagnose management problems.
2. Apply these theories and frameworks to themselves to become better leaders at work in a range of organizations
3. Evaluation of company's performance including financials, market share, innovation, and employment.
4. Analyze a job and use the information for consulting with organizations for selection purposes.
5. Develop specific HR systems for different regions and cultures such as recruitment, selection, compensation, performance management and training.
6. Development of implementation steps for strategic plans for functional areas such as marketing, sales, R&D, human resources, accounting, control, production and finance.
7. Create an innovative process, creating thinking with non stop technical problems, solving systems to enhance production.

28. Automobile Engineering

Course Code: GR14A3036

Course Outcomes:

1. Illustrate the function of each and every component of an automobile. As well as able to analyze the reasons for performance parameters.
2. Demonstrate about emission standards, emission control techniques and electrical systems. Student can identify thrust areas for carrying their dissertation in future.
3. Describe the every component of transmission system of an automobile viz clutch, gear box, propeller shaft and differential.
4. Predict the purpose and methods of steering systems and their applications.
5. Analyze the geometry of the steering mechanism and the effect of the same on tyre performance and other components of the automobile.

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6. Explain the working principles of the different components of the automobile based on different applications.
7. List the different types of suspension system and braking system of an automobile and importance of each type based on real time applications.

29. Mechatronics

Course Code: GR14A3037

Course Outcomes:

1. Employ the knowledge of mathematics, science, and engineering.
2. Design and conduct experiments to evaluate the performance of a mechatronics system or component with respect to specifications, as well as to analyze and interpret data.
3. Design mechatronics component, system or process to meet desired needs.
4. Use the techniques, skills, and modern mechatronics engineering tools necessary for engineering practice.
5. Communicate technical matters effectively in oral, written, and graphical form.
6. Identify and evaluate ethical ramifications and professional responsibilities in a variety of situations.
7. Discuss the impact of engineering on society, safety, and environment in relation to contemporary issues.

30. Power Plant Engineering

Course Code: GR14A3038

Course Outcomes:

1. Classify the types of coals and describe their properties
2. Compare the types of fossil fuel combustion methods in steam power plants
3. Examine the cooling and lubrication systems in diesel engine power plant
4. Explain the efficiency improvement techniques in gas turbine plants
5. Discuss the plant auxiliaries available in hydroelectric power plant
6. Assess the advantages of various non conventional energy sources
7. Investigate the power plant economics and environmental considerations

31. Heat Transfer Lab

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Course Code: GR14A3039

Course Outcomes:

1. Analyze the thermal conductivity of Metal rod with composite wall
2. Perform the Thermal conductivity of Insulation
3. Compute the thermal conductivity of Lagged pipe
4. Analyze the performance of in fins.
5. Calculate the heat transfer coefficients in free and forced convection heat transfer
6. Compute the rate of heat transfer in heat exchangers
7. Compute the emissivity of grey body using black body

32. Metrology Lab

Course Code: GR14A3040

Course Outcomes:

1. Identify the uncertainties in dimensional metrology and to define the measurement standards
2. Measure length and angles using line-graduated instruments, i. e. vernier calipers, micrometers, bevel protractor, sine bar and surface plates
3. Use the appropriate method for determination of accuracy based on product function and manufacturing capability.
4. Use comparative length-measuring instruments, i.e. dial indicator, to measure variations in the distance between two or more surfaces.
5. Use effective methods of measuring straightness, flatness, roundness, profile, screw threads and gear teeth.
6. Measure dimensions of shafts, bearings and linear surfaces in metric and imperial units using callipers, micrometers, and scales.
7. Use contour projector and coordinate measuring machine to record measurements of complex profiles with high sensitivity

33. Basic Finite Element Methods

Course Code: GR14A4039

Course Outcomes:

1. obtain an understanding of the fundamental theory of the FEA method
2. apply the concepts of minimum potential energy principles to solve structural mechanics problems.
3. Compute Eigen values and eigenvectors of simple dynamic systems

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4. obtain weak form from strong form and total potential, and recognize similarities between such solutions, and those obtained by variational principles and principle of virtual work.
5. develop the ability to generate the governing FE equations for systems governed by partial differential equations
6. obtain finite element solution and compare with exact solution of simple one dimensional problems.
7. apply the finite element procedure for stress analysis and design of load carrying structures and heat transfer problems

34. CAD/CAM

Course Code: GR14A4040

Course Outcomes:

The students which finish this course in a satisfactory manner can define tools used for computer aided Design (CAD) and Computer Aided manufacturing.

2. The students which finish this course in a satisfactory manner can explain geometric modelling techniques and recognize importance in modelling real life objects using CAD/CAM tools.
3. The students which finish this course in a satisfactory manner can interpret integration of two streams CAD and CAM.
4. The students which finish this course in a satisfactory manner can use computer graphic techniques, Computer aided process planning techniques (CAPP) and Group Technology concepts.
5. The students which finish this course in a satisfactory manner can appraise CNC programming using Numerical Control codes (NC) and Automatically programmed tools (APT) compared to conventional machining.
6. The students which finish this course in a satisfactory manner can recognize the importance of implementation of automation in phases of design and manufacturing industries.
7. The students which finish this course in a satisfactory manner can create or develop product life cycle of any product.

35. Operations Research

Course Code: GR14A4041

Course Outcomes:

1. Apply the various linear programming techniques for optimal allocation of limited resources such as machine, material and money

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2. Solve transportation problems to minimize cost and understand the principles of assignment of jobs and recruitment policies.
3. Apply Game theory to analyze various business competitions.
4. Distinguish various inventory models and develop proper inventory policies.
5. Solve sequencing problems.
6. Develop optimum replacement policy.
7. Solve Dynamic Programming Techniques.

36. Flexible Manufacturing System

Course Code: GR14A4042

Course Outcomes:

1. Apprehend the importance of FMS system in present manufacturing world
2. Classify and distinguish FMS and other manufacturing systems including job - shop and mass production systems.
3. Explain processing stations and material handling systems used in FMS environments.
4. Design and analyse FMS using simulation and analytical techniques.
5. Apprehend the importance of Group Technology in manufacturing the products
6. Employ the tool management in FMS.
7. Analyse the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS

37. Robotics

Course Code: GR14A4043

Course Outcomes:

1. Explain the Robot Anatomy and robot configurations
2. Employ the equipped with automation and Robot applications.
3. Analyze the kinematic motions of robot.
4. Examine robot end effectors and their design concepts.
5. Analyze the Programming methods & various Languages of robots.
6. Explain the principles of various Sensors and their applications in robots
7. Employ the concepts of Robot cell design and control

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38. Instrumentation and Control Systems

Course Code: GR14A4044

Course Outcomes:

1. Ability to apply knowledge of mathematics, science, and engineering.
2. Student will able to understand and explain the concepts of measurement of displacement, temperature and pressure using various devices.
3. Student will able to explain different types of measurements.
4. Be able to use different transducers for displacement measurement.
5. Be able to use the appropriate sensor to do the measurement including powering the sensor.
6. Illustrate level, flow, speed, vibration measurements.
7. Categorize methods of usage of resistance strain gauge for bending compressive and tensile strains.

39. Unconventional Machining Processes

Course Code: GR14A4045

Course Outcomes:

1. Illustrate the applications of various processes and also will be able to select an appropriate process for a specific requirement.
2. Demonstrate different processes and to appreciate the effect of process parameters on surface integrity aspects.
3. Employ importance of different processes and how it effects the performance of a component during its service life.
4. Appreciate the use of EDM as a method for machining complex shapes.
5. Analyze all the machining operations about how they occur, how to interpret and how to select the process.
6. Identify and recommend a particular process for a specific application.
7. Distinguish the difference between various processes in their process characteristics.

40. Renewable Sources of Energy

Course Code: GR14A4046

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Course Outcomes:

1. Explain renewable energy sources & systems
2. Apply engineering techniques to build solar, wind, tidal, geothermal, biofuel, fuel cell, Hydrogen and sterling engine.
3. Analyse and evaluate the implication of renewable energy concepts in solving numerical problems pertaining to solar radiation geometry and wind energy systems.
4. Demonstrate self learning capability to design & establish renewable energy systems.
5. Conduct experiments to assess the performance of solar PV, solar thermal and biodiesel systems
6. Compare different renewable energy technologies and choose the most appropriate based on local conditions
7. Identify the principles on Direct Energy Conversion and perform simple techno economical assessments of renewable energy systems

41. Computational Fluid Dynamics

Course Code: GR14A4047

Course Outcomes:

1. Describe the types of errors and instabilities in a numerical schemes
2. Examine various numerical FDM techniques available for solving in steady state and transient problems.
3. Implement FVM techniques to steady state and unsteady state problems in heat transfer.
4. Classify the partial differential equations and understand their physical behaviour in fluid flow problems.
5. Gain knowledge in various convection diffusion discretization schemes
6. Formulate the governing equations for structural problems by using CFD.
7. Calculate the flow field with SIMPLE and SIMPLER schemes.

42. CAD/CAM Lab

Course Code: GR14A4048

Course Outcomes:

The students which finish this course in a satisfactory manner can define tools used for computer aided Design (CAD) and Computer Aided manufacturing.

2. The students which finish this course in a satisfactory manner can explain geometric modelling techniques and recognize importance in modelling real life objects using CAD/CAM tools.
3. The students which finish this course in a satisfactory manner can interpret integration of two streams CAD and CAM.

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4. The students which finish this course in a satisfactory manner can use computer graphic techniques, Computer aided process planning techniques (CAPP) and Group Technology concepts.
5. The students which finish this course in a satisfactory manner can appraise CNC programming using Numerical Control codes(NC) and Automatically programmed tools (APT) compared to conventional machining.
6. The students which finish this course in a satisfactory manner can recognize the importance of implementation of automation in phases of design and manufacturing industries.
7. The students which finish this course in a satisfactory manner can create or develop product life cycle of any product.

43. Instrumentation and Control Systems Lab

Course Code: GR14A4049

Course Outcomes:

1. Ability to analyze Instrumentation systems and their applications to various industries.
2. Apply the working principles and design of Instruments used in the measurement of Quantities like displacement, temperature and pressure.
3. Ability to review, prepare and present technological developments
4. Analyze errors, integrate and interpret different types of measurements.
5. Illustrate load, flow, speed, vibration measurements.
6. Establish a course of action to solve problems.
7. Apply knowledge of mathematics, science, and engineering to the measuring Instruments.

44. Production Drawing Practice

Course Code: GR14A4050

Course Outcomes:

1. Perform improved basic sketching techniques
2. Draw Orthographic Projections and sections

ME BOS

3. Design Production Drawing Assemblies required to Industry
4. Estimate various fits, limits and tolerances
5. Study the Existing Assemblies
6. Illustrate Different Sections of Geometries
7. Apply Production Drawing techniques in Industry

45. Refrigeration and Air Conditioning

Course Code: GR14A4051

Course Outcomes:

1. Apply theoretical and mathematical principles to simple, complex vapor compression and vapor absorption refrigeration system.
2. Discuss the physical and mathematical aspects of refrigeration and air conditioning systems.
3. Explain HVAC technology, engineering, research, systems, system designs, energy impacts and overall goals.
4. Explain the conventional and alternate refrigerants and their impact on environment and develop understanding of the principles and practice of thermal comfort.
5. Explain the heat transfer and solar energy and develop techniques for the analysis of building envelope loads.
6. Apply basic principles of psychrometry and applied psychrometrics.
7. Investigate air conditioning systems and develop generalized psychrometrics of moist air and apply to HVAC processes.

46. Production Planning and Control

Course Code: GR14A4052

Course Outcomes:

1. Application of knowledge of production planning and scheduling to meet the target manufacturing sector
2. Team build up and interaction with all resource departments for resource balancing economic manner
3. Perform effectively on inventory management and application of control system for material management
4. Ability to solve problems by Routing Procedure
5. Application on ERP system for customer requirement planning and compare integration

ME BOS

6. Development of program based quality, cost and delivery requirements through planning, scheduling and control
7. Develop forecasting methods for proper planning

47. Plant Layout and Material Handling

Course Code: GR14A4053

Course Outcomes:

1. Explain charts with regard to a specific product: assembly chart, route sheet, operations process chart, from-to chart, and activity relationship chart
2. Identify equipment requirements for a specific process
3. Analyze the benefit of an efficient material handling system
4. Distinguish what effect process layout has on the material handling system
5. Recommend improvements to existing plant layouts from the standpoint of material handling and product flow
6. Design flexibility into a plant layout to accommodate changes in product volume or product line

Integrate concepts and techniques learned through this course in order to design and efficient plant layout in a team environment

48. Tribology

Course Code: GR14A4054

Course Outcomes:

1. Explain the broad based understanding of the interdisciplinary subject 'tribology' and its technological significance
2. Apply the basic theories of friction to predictions about the frictional behavior of commonly encountered sliding interfaces.
3. Analyze about consequences of wear, wear mechanisms, wear theories and analysis of wear problems.
4. Apply the principles of lubrication, lubrication regimes, theories of hydrodynamic, elastohydrodynamic and mixed/ boundary lubrication
5. Analyze the experimental techniques such as tribo testing
6. Characterize features of rough surface and liquid lubricants as they pertain to interface sliding.

ME BOS

7. Interpret the latest research on new topics in tribology including its application to nano scale devices and biological systems.

49. Mechanical Vibrations

Course Code: GR14A4055

Course Outcomes:

1. Illustrate the vibration analysis in mechanical design of machine parts that operate in vibratory conditions.
2. Develop a continuous vibrational system
3. Analyze the mathematical model of a linear vibratory system to determine its response.
4. Compute linear mathematical models for real life engineering systems.
5. Apply Lagrange's equations for linear and nonlinear vibratory systems.
6. Determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation.
7. Explain the general notion on frequency and time response of vibratory systems.

50. Nuclear Power Plant

Course Code: GR14A4056

Course Outcomes:

1. Find the resources of energies available in India for Power Production by Thermal and Nuclear Processes
2. Analyze the processes and cycles followed in Thermal Power Plants and nuclear power plants and Components used in the power plants and identify the losses to get better efficiency.
3. Apply the knowledge gained by analyzing the steam power plants, steam generators and gasTurbine power plants, to improve the efficiency and reduce the thermal losses.
4. Apply the knowledge in calculating the Power Load Calculations and Distribution.
5. Identify the methods for the Economies of Power Generation and Power plant instrumentation
6. Analyze the efficiency of nuclear power plant

ME BOS

7. Apply nuclear power techniques in day to day life for better efficiency

51. Optimization Techniques

Course Code: GR14A4057

Course Outcomes:

1. The students will be able to get awareness about the real world problems, their understanding and ability to formulate mathematical models of these problems.
2. Students will be able to understand the major limitations and capabilities of deterministic operations research modeling as applied to problems in industry or government.
3. The student will learn to handle, solve and analyzing problems using linear programming and other mathematical programming algorithms.
4. The students will also learn how to deal with real world problems of Network analysis, Project Management, for their optimal solutions;
5. The students will also be able to learn different techniques to solve Non- Linear Programming Problems.
6. Analyze the techniques methods, which are based on iterative methods, to find optimal solutions of Non-Linear Programming Problems.
7. Also students will be able to understand multistage decision problems.

52. CAM and Simulation Lab

Course Code: GR14A4058

Course Outcomes:

1. Illustrate the constructional features of Computer Numerical Control (CNC) Lathe and Milling Machines.
2. Demonstrate the CNC programming of Lathe and Milling machines (i.e. G and M codes) and Automated Programming Tools (APT) programming.
3. Develop the CNC programs for turning operations using basic codes and cycles
4. Develop the CNC programs for milling operations using basic codes and cycles
5. Create the components by performing the operations on the CNC lathe and Milling machines.
6. Apply CAM software like Master CAM or CADEM to generate CNC programs automatically.
7. Employ the robot programming for material handling