Scheme of Teaching & Examination of Bachelor of EngineeringMinors Specialization (Mechanical Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	METM301	Manufacturing Engineering	3	0	0	3.00	40	60	100	3 Hrs.
2.	METM401	Automotive Engineering	3	0	0	3.00	40	60	100	3 Hrs.
3.	METM501	Computer Aided Design	3	1	0	4.00	40	60	100	3 Hrs.
4.	METM601	Solar Energy Technology	3	1	0	4.00	40	60	100	3 Hrs.
5.	METM701	Project (Minors)	0	0	8	4.00	50	50	100	-

III Semester (Minor Specialization)
Department of Mechanical Engineering

Course Code : METM301 **Course : Manufacturing Engineering**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 03**

Course Objectives

To prepare students to equipment and understand the various processes required for product manufacturing.

Course Outcomes

The expected learning outcome is that the students will be able to:

1. Select a suitable manufacturing process for desired components.
2. Select a suitable engineering material for a product to manufacture.
3. Select a suitable casting/forming method to manufacture metal components.
4. Select suitable joining processes for fabrication work of ferrous and non ferrous metals.
5. Identify the machine tool, cutting tool materials and cutting fluids for different machining operations.
6. Select an appropriate NTM and advanced machining process for manufacturing complex shape component.

Syllabus

Unit - I

Introduction, Classification of manufacturing processes, kinds of production, computers in manufacturing, selection of manufacturing process. (3)

Unit-II

Engineering materials and their properties, importance of heat treatment. (5)

Unit-III

Primary manufacturing processes. Introduction to casting, forming ,Rolling ,forging, extrusion and sheet metal working processes, processing of plastics. (8)

Unit-IV

Fabrication processes, classification of welding processes, Soldering, brazing and advanced welding processes. (6)

Unit-V

Metal cutting, Single and multi-point cutting tools, Cutting tool materials, Tool life, Cutting fluids, Types of machine tools, Turning, Drilling, Milling and finishing processes, (8)

Unit-VI

Unconventional and Advanced Machining Processes:

Abrasive Jet Machining, Electrical Discharge Machining, Electro-chemical machining (ECM), Laser Beam Machining (LBM), Electron Beam Machining

Introduction to CNC, FMS, GT and CIMS. (10)

Text Books

1. Manufacturing Technology (Vol I and II) – P.N. Rao, Tata McGraw Hill Pub. Company, New Delhi.
2. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014
3. Production Engineering –P.C. Sharma, S. Chand and Company Ltd., New Delhi.

Reference Books

1. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi.
2. Workshop Technology (Volume-I & II) - By Hajra Choudhary, Media Promoters & Publishers Pvt. Ltd.
3. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems.

IV Semester (Minor Specialization)
Department of Mechanical Engineering

Course Code : METM401 **Course : Automotive Engineering**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 03**

Course Objectives

1. To give insight of the various systems that constitute the modern automobile and the latest trends.
2. To provide an overview of automobile emissions and details of electric vehicle.

Course Outcomes

The expected learning outcome is that the students will be able to:

1. Recognize the fundamentals and applications of various types of automobiles and I.C engines.
2. Identify various fuels for I.C engine, fuel supply system and formation and control of emissions.
3. Illustrate the importance and working of transmission, driveline components including tyres.
4. Explore components and working of steering, braking and suspension system and their importance.
5. Demonstrate the importance and functioning of various electrical, electronic devices and safety systems.
6. Express the need and functional requirements of Electric and hybrid vehicles and latest trends in Automobile.

Syllabus

UNIT I : Introduction and Classification of automobiles, Chassis types and construction, I.C Engines, Lubrication and Cooling. 08 hr

UNIT II : Fuels for I.C Engines, Alternate Fuel, Fuel Supply systems: Carburetor and Fuel Injection system, CRDi. Emissions and its Control. 07hr

Unit III : Transmission and Drive Line Components: Clutches, Gearbox, Driveline Components, Differential. Axles, wheels and Tyres. 08 hr

UNIT IV : Steering, Suspension and Braking system: Need, classification, working, latest trends. 07 hr

UNIT V : Auto Electricals and Electronics, Automotive Lighting, Safety. 08 hr

UNIT VI : Hybrid and Electric vehicles, Auto Mechatronics and latest trends. 07 hr

Text Books

1. Automobile Engineering Vol. 1 & Vol. 2 by Kirpal Singh, Standard Publishers.
2. Automobile Engineering by G.B.S. Narang, Khanna publisher
3. Motor Vehicle Technology -- J.A. Dolan, Heinemann Educational Books

Reference Books

1. Automotive Mechanics -- W.H. Crouse, D.L Anglin, Tata McGraw Hill Education.
2. Motor Vehicle -- K. Newton and W. Seeds, T.K. Gawet, Butterworth, Limited, London, England,
3. Automotive Machanics -- Joseph Heitner, Van Nostrand Reinhold

V Semester (Minor Specialization)
Department of Mechanical Engineering

Course Code : METM501 **Course : Computer Aided Design**

L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week **Total Credits : 04**

Course Objectives

To understand the basic concept of computer graphics to develop welding software and finite element method to analyse the machine element.

Course Outcomes

The expected learning outcome is that the students will be able to:

1. Understand the basic concept of computer aided design and computer graphics.
2. Understand the technique to display of graphical entities like line, circle and ellipse.
3. Apply the knowledge of 2-D transformation to manipulate a geometrical entity.
4. Comprehend the concept of 3-D transformation and various techniques of modeling.
5. Learn the basic concept and applications of FEM to analyze the machine element.
6. Analyze the structure by one dimensional element i.e. 1-D bar and 2-D trusses.

Syllabus

Unit – I: CO1 : Definition of CAD and its application, CAD Softwares modules (Operating System, Graphics, Applications, Programming, Communication). Product life cycle, Various techniques to generate the images, frame buffer, N-bit plane buffers, simple color frame buffer.

Unit – II: CO2 : Rasterization Principle, Rasterization of line, Generation of line, circle and ellipse using Bresenham's and DDA algorithms. Windowing and clipping, Cohen- Sutherland Clipping Algorithm.

Unit-III: CO3 : Two dimensional geometric and co-ordinate transformations like scaling, translation, rotation, reflection, and shear. Concept of homogeneous representation and concatenated transformations. Inverse transformations. (Enumeration of entity on graph paper)

Unit – IV: CO4 : Three dimensional geometric and co-ordinate transformation like scaling, translation, rotation and reflection.

Bezier Curve (for 4 Control points).Introduction to surfaces, surface of revolution. Wire frame modeling, solid modeling of basic entities like box, cone, cylinder. CSG & B-rep technique.

Unit – V: CO5 : Fundamental Concept of Finite Element Method, historical background and applications. Concept of stress analysis, Plain Stress and Strain, Compatibility condition, Minimum potential energy principle. Raleigh-Ritz method, Saint Venant's principle, sky line approach.

Unit – VI: CO6 : Analysis of one dimensional bar and spring element, Displacement function, shape functions for linear & quadratic bar element. Stiffness matrix, Force Matrix. Analysis of two-dimensional trusses.

Text Book

1. Schaum's Outline Series: Theory & Problems of Computer Graphics Roy A. Plastock, Gordon Kalley
2. Introduction to Finite Elements in Engineering: Chandrupatla & A. D. Belegundu (PHI)

Reference Book

1. CAD/CAM, Theory & Practice: Ibrahim Zeid (McGraw Hill)
2. Procedural elements for computer Graphics: D Rogers (McGraw Hill)
3. Mathematical Elements for Computer Graphics Dravid F Rogers, J. Alan Adams (McGraw Hill)
4. Schaum's Outline Series: Theory & Problems of Computer Graphics Roy A. Plastock, Gordon Kalley

VI Semester (Minor Specialization)
Department of Mechanical Engineering

Course Code : METM601 **Course : Solar Energy Technology**

L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week **Total Credits : 04**

Course Objectives

To provide a comprehensive insight of solar energy collection and utilization for thermal and electrical applications.

Course Outcomes

The expected learning outcome is that the students will be able to:

1. Understand the basic terminologies in solar energy technology.
2. Estimate and measure the insolations for given location and time of year.
3. Understand various ways of solar energy utilization.
4. Understand the working of different solar thermal systems.
5. Understand construction and working of different PV systems.
6. Give a preliminary design of typical solar heating and photovoltaic systems.

Syllabus

Energy Scenario and Solar Resources

Global energy scenario, status of solar energy utilization in the world, Introduction to electromagnetic spectrum, solar spectrum, estimation of extraterrestrial radiations, solar constant, air mass, attenuation of solar radiations through atmosphere, solar geometry, measurement of solar radiations, empirical equations for predicting availability of terrestrial radiations

Solar Thermal systems

Principles of solar thermal energy collection, different types of solar thermal collectors, novel designs of collectors, solar energy storage: sensible, latent and thermo chemical storage.

Solar thermal applications

Water and space heating; solar ponds; dryers, distillation, solar cookers, Solar thermal power plants, design of solar thermal systems.

Basics of solar photovoltaics

Photovoltaic effect, different types of photovoltaic cells, cell materials, Module specifications, manufacturing of PV cells and modules, PV cell characteristics, cost of PV technologies.

Components of Photovoltaic Systems

balance of PV systems, module hot spots, bypasses diodes, PV arrays and PV systems, mounting structures, series and parallel connections of PV modules, mismatch in PV connections, charge controllers, MPPT, cables, storage batteries, inverters.

Design of PV Systems Standalone

PV systems, grid connected PV systems **Text Books :**

1. Solar Energy: Principles of Thermal Collection and Storage, S.P. Sukhatme, 2nd edition, Tata McGraw Hill New Delhi, 1984.
2. Solar Photovoltaics: Fundamental Applications and Technologies, C. S. Solanki, 2nd edition, Prentice Hall of India New Delhi 2011.

Reference Books

1. Solar Engineering of Thermal Processes, Duffie. J. A. & W. A. Beckman, 3rd edition, John Wiley & Sons, 2006.
2. Renewable Energy Resources, John Twidell, Tony Weir, Taylor & Francis; 2nd edition, 2005
3. Solar Energy Fundamentals and applications, H.P,Garg, J Prakash,1st edition, Tata Mc Graw Hill, New Delhi, 1997.

VII **Semester (Minor Specialization)**

Department of Mechanical Engineering

Course Code: METM701 **Course: Project (Minors)**

L: 0 Hrs. T: 0 Hrs. P: 8 Hrs. Per week **Total Credits: 04**

Course Objectives:

To gain exposure to the process of resolving real-world problems, product development and industrial challenges in order to arrive to insightful conclusions, design products, and find solutions.

Course Outcomes:

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

1. Carry out a thorough theoretical analysis/simulation study/model fabrication/experimental work in accordance with the problem solution requirements.
2. Interpret the results of simulation or experimental studies to reach a specific conclusion or decision to repeat the studies.
3. Ability to arrive to a precise and acceptable conclusion about the study
4. To compile the findings, prepare a thorough presentation and a full project report.

On the completion of work, the students should submit the final report in a prescribed format as per the guidelines. Term work will be assessed by the project guide along with project evaluation panel, on continuous evaluation basis.