Program Educational Objectives and Program Outcomes
B.E. (Mechanical Engineering) Program

Program Educational Objectives:

- Impart knowledge of mathematics, basic and applied sciences.
- Ability to identify, formulate and solve mechanical engineering problems based on data interpretation, design, experiment and analysis of results.
- Learn effective engineering communication.
- Ability to work in teams on multi-disciplinary projects in industry and research organizations.
- Develop awareness of the ethical, professional and environmental implications of work in a global and societal context.
- Ability to self-learn modern engineering tools, techniques, skills and contemporary engineering practice, necessary for engineering work.

Program Outcomes:

The students of Bachelor of Engineering in Mechanical Engineering will have the ability to

- apply knowledge of mathematics, science, and engineering.
- design and conduct experiments, as well as to analyze and interpret data.
- design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- function on multidisciplinary teams.
- identify, formulate and solve engineering problems.
- understand professional and ethical responsibility.
- communicate effectively.
- understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- recognize the need to engage in life-long learning
- attain knowledge of contemporary issues.
- use the techniques, skills, and modern engineering tools necessary for engineering practice.

SCHEME OF COURSES FOR BE (Mechanical Engineering)

First Semester

S.No.	Course No.	Course Name	L	T	P	Cr
1.	UMA001	Mathematics - I	3	1	0	3.5
2.	UPH001	Applied Physics	3	1	2	4.5
3.	UES002	Solid Mechanics	3	1	2	4.5
4.	UHU001	Business and Technical Communication	2	0	2	3.0
5.	UTA001	Engineering Graphics	2	4	0	4.0
6.	UTA003	Computer Programming	3	0	2	4.0
7.		Introduction to Mechanical Engineering	2	0	0	2.0
		Total	**18**	**7**	**8**	**25.5**

Second Semester

S.No.	Course No.	Course Name	L	T	P	Cr
1.	UMA002	Mathematics - II	3	1	0	3.5
2.	UCB001	Applied Chemistry	3	1	2	4.5
3.	UTA002	Manufacturing Processes	2	0	3	3.5
4.	UES001	Electrical and Electronics Science	3	1	2	4.5
5.	UES003	Engineering Thermodynamics	3	1	0	3.5
6.		Elective I	3	1	0	3.5
		Total	**17**	**5**	**7**	**23.0**

Elective I

1. Biological Applications in Engineering
2. Introduction to Industrial Design
3. Internet and Java Programming
4. Bio-Computing and Genetic Engineering
5. Nuclear Power Engineering
6. Renewable Energy Materials
7. Biological Chemistry
8. Chemical Analytical Techniques

Third Semester

S.No.	Course No.	Course Name	L	T	P	Cr
1.	UMA003	Numerical Analysis and Statistical Methods	3	0	2	4.0
2.	UHU003	Human Values, Human Rights & IPR	2	1	0	2.5
3.	UEN001	Environmental Studies	2	0	0	2.0
4.	UES031	Fluid Mechanics	3	1	2	4.5
5.		Applied Thermodynamics	3	1	2	4.5
6.		Kinematics of Machines	3	1	0	3.5
7.		Machine Drawing	1	4	0	3.0
		Total	**17**	**8**	**6**	**24**

Fourth Semester

S.No.	Course No.	Course Name	L	T	P	Cr
1.	UMA004	Optimization Techniques	3	1	0	3.5
2.		Organizational Behavior	3	1	0	3.5
3.	UES003	Material Science and Engineering	3	1	2	4.5
4.		Computer Aided Geometric Modeling and Analysis	2	4	0	4.0
5.		Dynamics of Machines	3	1	0	3.5
6.		Inspection and Quality Control	3	1	2	4.5
7.		Mechanics of Deformable Bodies	3	1	0	3.5
		Total	**20**	**10**	**4**	**27.0**

Fifth Semester

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Industrial Engineering	3	0	2	4.0
2.		Automobile Engineering	3	0	2	4.0
3.		Industrial Metallurgy and Materials	3	1	0	3.5
4.		Machine Design	3	1	0	3.5
5.		Manufacturing Technology	3	0	3	4.5
6.		Heat and Mass Transfer	3	1	2	4.5
7.		Industrial Automation	3	1	0	3.5
8.		Summer Training (Four weeks during summer vacations after 2nd year)				4.0
		Total	**21**	**4**	**9**	**31.5**

Sixth Semester

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Project Semester*				12.0
		Total				**12.0**

OR

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Project				2.0
2.		Product Design and Development	3	1	0	3.5
3.		Production and Inventory Control	3	1	0	3.5
4.		Elective II	3	0	0	3.0
		Total	**8**	**3**	**0**	**12.0**

* To be carried out in Industry/Research Institution.

Seventh Semester

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Advanced Machine Design	3	2	0	4.0
2.		Computer Aided Manufacturing	3	0	2	4.0
3.		Fluid Machinery	3	1	2	4.5
4.		Mechanical Vibrations	3	1	0	3.5
5.		Machining Science	3	1	2	4.5
6.		Engineering Economics	3	1	0	3.5
7.		Capstone Project Part-I	0	0	4	2.0
		Total	**18**	**6**	**10**	**26**

Eight Semester

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Mechatronics	3	0	2	4.0
2.		Refrigeration and Air Conditioning	3	1	2	4.5
3.		Turbomachines	3	1	0	3.5
4.		Capstone Project Part-II	0	0	6	3.0
5.		Elective III	3	1	0	3.5
6.		Elective IV	3	1	0	3.5
7.		Elective V	3	1	0	3.5
		Total	**18**	**5**	**10**	**25.5**

List of Electives

Elective-II

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Work Study and Methods Engineering	3	0	0	3.0
2.		Lean Manufacturing	3	0	0	3.0
3.		Facility Planning	3	0	0	3.0
4.		Ergonomics Engineering	3	0	0	3.0

Elective-III

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Computational Fluid Dynamics	3	1	0	3.5
2.		Internal Combustion Engines	3	1	0	3.5
3.		Power Plant Engineering	3	1	0	3.5
4.	PTH322	Renewable Energy Systems	3	1	0	3.5
5.		Gas Turbines and Jet propulsion	3	1	0	3.5
6.		Modern Automobile Engineering	3	1	0	3.5

Elective-IV

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Finite Element Methods	3	1	0	3.5
2.		Mechanics of Composite Materials	3	1	0	3.5
3.		Robotics Engineering	3	1	0	3.5
4.		Machine Tool Design	3	1	0	3.5
5.		Dynamics of Rigid Bodies	3	1	0	3.5
6.		Tribology of Bearings	3	1	0	3.5

Elective-V

S.No.	Course No.	Course Name	L	T	P	Cr
1.		Supply Chain Management	3	1	0	3.5
2.		Design of Experiments and Analysis	3	1	0	3.5
3.	PCD325	Rapid Prototyping	3	1	0	3.5
4.		Processing of Polymers and Composites	3	1	0	3.5
5.		Micro and Nano Manufacturing	3	1	0	3.5

Total Credits: 194.5

UTA001 ENGINEERING GRAPHICS

L	T	P	Cr
2	4	0	4.0

Prerequisite(s): None

Course Objectives: To inculcate the imagination and mental visualization capabilities for interpreting the geometrical details of common engineering objects. To impart knowledge about principles/methods related to projections of one, two and three dimensional objects.

Introduction: Use of drafting tools, Lettering, Dimensions and Standards, Line Conventions.

Projection Systems: Projection Planes, Projection systems, Orthographic projections of points in first angle projection system and third angle projection system, Orthographic projections of lines on reference planes, True length of line using rotation of view method, Traces of lines, Auxiliary planes and their applications, Projections of Lamina parallel/inclined to reference planes, Projection of solids- Polyhedra, Solids of revolution, Sections of solids- Section plane parallel / inclined to reference planes, Intersection of solids.

Development of Surfaces: Development of surfaces like Prism, Pyramid, Cylinder, Cone, Sphere etc. using Parallel Line Method, Radial Line Method, Triangulation method.

Orthographic Projections: Extracting Orthographic projections from given pictorial views.

Isometric Views: Extracting Isometric projections from given Orthographic views using box method, Offset method.

Missing Lines and Missing Views: Evaluating missing lines and missing views from given orthographic views.

Computer Aided Drafting: Introduction to computer drafting tools like AutoCAD. Demonstration of commands like Line, Circle, Arc, Rectangle, MText and Dimensioning etc.

Course Outcomes:
The students will be able to

- Imagine and visualize the geometric details of engineering objects.
- Translate the geometric information of engineering objects into engineering drawings.
- Use computer aided drafting in their respective engineering field.

Text Books

1. *Gill, P.S., Geometrical Drawings, S.K. Kataria & Sons (2008).*
2. *Mohan, K.R., Engineering Graphics, Dhanpat Rai Publishing Company (P) Ltd (2002).*

Reference Books

1. *French, T. E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company (2005).*
2. *Bhatt, N.D., Engineering Drawing, Charotar Publishing House (2003).*

UTA002 MANUFACTURING PROCESSES

L	T	P	Cr
2	0	3	3.5

Prerequisite(s): None

Course Objectives: To introduce basic manufacturing processes used in industry. To identify, analyze, and solve problems related to basic manufacturing processes both independently and as a part of a team.

Introduction: Common engineering materials and their important mechanical and manufacturing properties, General classification of manufacturing processes.

Metal Casting: Principles of metal casting, Patterns, Their functions, Types, Materials and pattern allowances, Characteristics of molding sand, Types of cores, Chaplets and chills, their materials and functions, Moulds and their types, Requisites of a sound casting, Introduction to Die Casting.

Metal Forming and Shearing: Forging, Rolling, Drawing, Extrusion, Bending, Spinning, Stretching, Embossing and Coining, Die and Punch operation in press work, Shearing, Piercing and blanking, Notching, Lancing.

Machining Processes: Principles of metal cutting, Cutting tools, their materials and applications, Geometry of single point cutting tool, Cutting fluids and their functions, Basic machine tools and their applications, Introduction to non-traditional machining processes (EDM, USM, CHM, ECM, LBM, AJM, and WJM).

Joining Processes: Electric arc, Gas, Resistance and Thermit welding, Soldering, Brazing and Braze welding, Adhesive bonding, Mechanical fastening (Riveting, Screwing, Metal stitching, Crimping etc.).

Plastic Processing: Plastics, their types and manufacturing properties, Compression molding, Injection molding and Blow molding, Additives in Plastics.

Modern Trends In Manufacturing: Introduction to numerical control (NC) and computerized numerical control (CNC) machines.

Laboratory Work:

Relevant shop floor exercises involving practice in pattern making, Sand casting, Machining, Welding, Sheet metal fabrication techniques, Fitting work and surface treatment of metals, Demonstration of Forge welding, TIG/MIG/GAS/Spot/Flash butt welding, Demonstration on Shaper, Planer and Milling machine.

Course Outcomes:

The students will be able to

- Identify and understand the basic manufacturing processes like single and multipoint machining, forming, welding, casting etc.
- Acquire basic operational skills in different manufacturing processes like machining, forming, welding, casting, sheet metal operations, pattern making etc.

Text Books

1. *Degarmo, E. P., Kohser, R. A. and Black, J. T., Materials and Processes in Manufacturing, Prentice Hall of India (2002).*
2. *Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Pearson Education Asia (2000).*

Reference Books

1. *Chapman, W. A. J. , Workshop Technology, Vol.1 & II, Arnold Publishers (2001).*
2. *Zimmer E. W. and Groover, M. P., Computer Aided Designing and Manufacturing,*

Prentice Hall of India (2008).
3. *Pandey, P. C. and Shan, H. S., Modern Machining Processes, Tata McGraw Hill (2004).*
4. *Mishra, P. K., Non Conventional Machining, Narosa Publications (2006).*
5. *Campbell, J. S., Principles of Manufacturing, Materials and Processes, Tata McGraw Hill Company (1995).*
6. *Lindberg, A. R., Process and Materials of Manufacture, Prentice Hall of India (1998).*

UES003 ENGINEERING THERMODYNAMICS

L	T	P	Cr
3	1	0	3.5

Prerequisite(s): None

Course Objectives: To understand the first, second law of thermodynamics, availability, the concept entropy change and entropy generation as applied to a variety of engineering systems.

Introduction and Basic Concepts: Role of Thermodynamics in Engineering and Science, Applications of Thermodynamics, Power Generation, Role of thermodynamics to analysis of mechanical and chemical systems, Cooling of Electrical Systems and Electronic Devices. Concept of Continuum, Macroscopic approach, Thermodynamics system & properties, Various processes, Thermodynamic equilibrium, Ideal gas, Vander Waals equation of state, Compressibility chart, Process: Flow and non flow process, Cycle concept of work and heat, Specific heats, Zeroth law, Energy and its form, Pure substance, Thermodynamic diagrams, Triple point, Steam tables and their use.

First Law of Thermodynamics: Concept of internal energy & enthalpy, Energy equation as applied to a close and open system, PMMI, Transient flow processes.

Second Law of Thermodynamics & its Corollaries: Kelvin Plank and Clausius statements, Reversible and Irreversible processes, Carnot cycle, Clausius theorem and concept of entropy, Principle of increase of entropy, PMM2, Thermodynamic temperature scale, Second law analysis of control volume, Availability, Irreversibility, Availability function for open and closed system & second law efficiency.

Thermodynamic Cycles: Rankine cycle, Vapour compression refrigeration cycle, Air standard cycles: Otto, Diesel Cycle

Boiler: Classification of boilers, Comparison of water and fire tube boilers, Mounting and Accessories with their functions, Constructional and operational details of water and fire tube boilers, Concept of the fluidized bed boiler.

Non Reacting Gas Mixtures: Properties of mixtures of gases and vapours, Adaibatic saturation, Properties of air.

Course Outcomes:

The students will be able to

- Understand the basic principles of thermodynamics like conservation of mass, conservation of energy and the second law of thermodynamics.
- Formulate and solve engineering problems involving closed and open systems for both steady state and transient processes.
- Analyze the performance of various power cycles and to identify methods for improving thermodynamic performance.

Text Books

1. *Wylon, V., Thermodynamics, John Wiley & Sons (2007).*
2. *Nag, P.K., Thermodynamics, Prentice Hall of India (2008).*

Reference Books

1. *Rao, Y.V.C., Introduction to Thermodynamics, Universities Press (2007).*
2. *Radha Krishnan, P., Fundamentals of Engineering Thermodynamics, Prentice Hall of India (2005).*
3. *Cangel, Y. A. and Bales, M., Thermodynamics, Tata McGraw Hill (2008).*
4. *Rogers, G. and Mayhew, Y., Engineering Thermodynamics, Pearson Education (1999).*

INTRODUCTION TO MECHANICAL ENGINEERING

L	T	P	Cr
2	0	0	2.0

Prerequisite(s): None

Course Objectives: To introduce the Mechanical Engineering discipline and its applications to society. Preparatory course presented in digital audio-visual, non-analytical form to inspire students to take up Mechanical Engineering as a career.

Introduction: General engineering as an application of basic sciences. Historical perspective in the development of Mechanical Engineering. Development of current specializations under Mechanical Engineering and their scope.

Overview of Mechanical Engineering:

Mechanical Design: Overview of Strength of Materials, Mechanics, Kinematics and Dynamics of Machines, Machine Design, Computer Aided Design.

Production and Industrial Engineering: Overview of Manufacturing Processes and Technology, Computer Aided Manufacturing, Measurements and Metrology, Industrial Engineering.

Thermal Engineering: Thermodynamics, Fluid Mechanics and Machines, Heat and Mass Transfer, Refrigeration and Air Conditioning, Power Plants.

Applications of Mechanical Engineering: Details of the applications of Mechanical Engineering and other engineering and science disciplines exemplifying the job potential. Examples to show and discuss: Transportation: Land - automobiles, bicycle, train, earthmovers, etc., Aerospace – aircraft etc., Sea – Ships etc., Energy: Conventional energy - thermal power, nuclear, hydel plant etc, Renewable energy - solar, wind, biomass etc., Process industries: chemical, petrochemical, paper, pharmaceutical, fertilizer plants etc.

Latest developments in Mechanical Engineering i.e., Robotics, Mechatronics, Automation etc.

Course Outcomes:

The students will be able to

- Understand the scope of engineering, especially Mechanical Engineering and its impact on society.
- Know about different fields of applications of Mechanical Engineering and its interrelationship with other fields of science and engineering.

Text Books

1. *Devendra Vashist, Mechanical Engineering: Fundamentals, I. K. International Publishing House Pvt. Ltd., New Delhi (2010).*
2. *Sawhney, Fundamentals of Mechanical Engineering, PHI Learning, New Delhi (2011).*

Reference Books

1. *Jonathan Wickert, An Introduction to Mechanical Engineering, Nelson Engineering (UK) (2010).*
2. *John Bird and Carl Ross, Mechanical Engineering Principles, Routledge, New York (2012).*