Jabalpur Engineering College, Jabalpur

Semester VIII Credit Based Grading System (CBGS) w.e.f. July 2018
Scheme of Examination
Bachelor of Engineering B.E. (Mechanical Engineering)
Subject Wise Distribution of Marks and Corresponding Credits
Scheme of Examination w.e.f. July 2018 Academic Session 2018-19

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
			Theory			Practical			L	T	P	
			End. Sem.	Mid Sem. MST	Quiz, Assignment	End Sem.	Lab Work					
1	ME8001	Advance Machine Design	70	20	10	30	20	150	3	1	2	6
2	ME8002	Automobile Engineering	70	20	10	30	20	150	3	1	2	6
3	ME8003	Elective-V	70	20	10	-	-	100	3	1	-	4
4	ME8004	Elective-VI	70	20	10	-	-	100	3	1	-	4
5	ME8005	Project-II	-	-	-	120	80	200	-	-	8	8
6	ME8006	CAD/CAM/CIM Lab	-	-	-	-	50	50	-	-	2	2
7	ME8007	Group Discussion/Seminar (Internal Assesment)	-	-	-	-	50	50	-	-	2	2
		Total	**280**	**80**	**40**	**180**	**220**	**800**	**12**	**4**	**16**	**32**

MST: Minimum of two mid semester tests to be conducted.

L: Lecture **T: Tutorial** **P: Practical**

Department Elective-V (Three Subjects)			Department Elective-VI (Three Subjects)	
S.No.	Subject Code	Subject Name	Subject Code	Subject Name
1	ME8003A	CAD/CAM/CIM	ME8004A	Energy Conservation & Audit
2	ME8003B	Tribology	ME8004B	Product Design
3	ME8003C	Advance Machining Processes	ME8004C	Maintenance Management

Principal
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

Jabalpur Engineering College, Jabalpur
(Credit Based Grading System Based Scheme)
Bachelor of Engineering (CBGS) Semester: VIII (Mechanical Engg.)

(w.e.f. July 2018)

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
ME8001	Advance Machine Design	70	20	10	30	20	150	3	1	2	6

Course Objective

- Understand the design concepts of belt, rope and chain drives.
- Able to design different types of gears.
- Able to design I.C. Engine components, different types of couplings and power screw.

Course Contents:

Unit- I: Design of Belt, Rope and Chain Drives: Methods of power transmission, design of flat belt drive and V-belt drive ; Design of chain drives, roller chain and its selection; Design of rope drives.

Unit- II: Spur and Helical Gears: Force analysis of gear tooth, AGMA Bending stress equation and AGMA Contact stress equation, modes of failure, beam strength, Lewis equation, form factor, formative gear and virtual number of teeth; Gear materials; Surface strength and wear of teeth; strength against wear; Design of straight tooth spur and Helical Gears.

Unit- III: Bevel Gears: Application of bevel, formative gear and virtual number of teeth; Force analysis; Lewis equation for bevel gears; Strength against wear; Design of bevel gear.

Unit- IV: Design of I.C. Engine Components: General design considerations in I C engines; design of cylinder; design of piston and piston-rings; design of connecting rod; design of crankshaft.

Unit -V: Design of Miscellaneous Components: Design of Flanged coupling; Rigid coupling and Flexible coupling , Design of Pressure vessels subjected to internal pressure, Design of power screw.

References:

1. Shigley J.E.; Machine Design; TMH
2. BhandariVB; Design of Machine Elments; TMH
3. Sharma CS and Purohit K; Design of Machine Elements; PHI Learning.
4. Hall and Somani; Machine Design; Schaum Series; TMH
5. Wentzell TH; Machine Design; Cegage Learning
6. Sharma & Agrawal; Machine Design; Katson
7. Kulkarni SG; Machine Design; TMH
8. Abdul Mubeen; Machine Design; Khanna Publishers
9. Juvinall RC, Marshek KM; Fundamentals of Machine Component Design; Wiley
10. Norton R; Design Of Machinery; TMH
11. Rajendra Karwa - Machine Design L.P. Delhi

Note: PSG Design data book and/ or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority)

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Course Outcomes:

At the completion of this course, students should be able to-

CO1	Analyze belt, rope and chain drives.
CO2	Distinguish between different types of gears.
CO3	Examine I.C. Engine Components (cylinder ,piston, piston-rings, connecting rod and crankshaft.)
CO4	Inspect miscellaneous components such as flanged coupling, rigid coupling, and pressure vessels.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	1	0	1	1	0	1
CO2	3	2	2	1	1	1	0	0	3	0	3	2
CO3	2	1	1	1	2	0	0	0	0	1	0	1
CO4	2	3	3	2	0	1	0	0	2	0	3	2

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
ME8002	Automobile Engineering	70	20	10	30	20	150	3	1	2	6

COURSE OBJECTIVE:

The students will be made to learn.

- The anatomy of the automobile in general.
- The location and importance of each part of automobile.
- The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels, suspension, frame, springs and other connections.
- The effect of automobile emissions on environment and how to control pollution.

Course Contents:

Unit-I: Chassis & Body Engg: Types, Technical details of commercial vehicles, types of chassis, layout, types of frames, testing of frames for bending & torsion on unutilized body frame, vehicle body and their construction, driver's visibility and methods for improvement, safety aspects of vehicles, vehicle aerodynamics, optimization of body shape, driver's cab design, body materials, location of engine, front wheel and rear wheel drive, four wheel drive.

Unit-II: Steering System: front axle beam, stub axle, front wheel assembly, principles of types of wheel alignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toe-out, condition for true rolling motion, centre point steering, directional stability of vehicles, steering gear, power steering, slip angle, cornering power, over steer & under steer, gyroscopic effect on steering gears.

Unit-III: Transmission System: Function and types of clutches, single plate, multi-plate clutch, roller & spring clutch, clutch lining and bonding, double declutching, types of gear boxes, synchroniser, gear materials, determination of gear ratio for vehicles, gear box performance at different vehicle speed, automatic transmission, torque converters, fluid coupling, principle of hydrostatic drive, propeller shaft, constant velocity universal joints, differential gear box, rear axle construction.

Unit-IV: Suspension system : Basic suspension movements, Independent front & rear suspension, shock absorber, type of springs: leaf spring, coil spring, air spring, torsion bar, location of shackles, power calculations, resistance to vehicle motion during acceleration and breaking, power & torque curve, torque & mechanical efficiency at different vehicle speeds, weight transfer, braking systems, disc theory, mechanical, hydraulic & pneumatic power brake systems, performance, self-energisation, air-bleedingof hydraulic brakes, types of wheels and tyres, tyre specifications, construction and material properties of tyres& tubes.

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Unit-V: Electrical and Control Systems: Storage battery, construction and operation of lead acid battery, testing of battery, principle of operation of starting mechanism, different drive systems, starter relay switch, regulator electric fuel gauge, fuel pump, horn, wiper, lighting system, head light dazzling, signaling devices, battery operated vehicles, choppers, importance of maintenance, scheduled and unscheduled maintenance, wheel alignment, trouble Shooting probable causes & remedies of various systems, microprocessor based control system for automobile, intelligent automobile control systems.

Unit-VI: Emission standards and pollution control: Indian standards for automotive vehicles-Bharat I, II, III, IV, Euro I to Euro VI norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives, and modern trends in automotive engine efficiency and emission control.

References:

1. Crouse , Automotive Mechanics TMH.
2. Srinivasan S; Automotive engines; TMH
3. Gupta HN; Internal Combustion Engines; PHI;
4. Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub.
5. Kripal Singh, Automotive Engineering Khanna Pub.
6. Newton &Steeds , Automotive Engineering
7. Emission standards from BIS and Euro –I to Euro-VI

At the completion of this course, students should be able to

CO1	Enlist the major parts of an automobile
CO2	Analyze the steering, transmission, suspension, electrical and control systems of an automobile.
CO3	Explain the environmental implications of automobile emissions.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
ELECTIVE-V ME8003A	CAD/CAM/CIM	70	20	10	-	-	100	3	1	-	4

Course Objective

- Understand the concepts of product design in CIM environment.
- Able to Create mathematical models to characterize curves and surfaces.
- Understand the Concepts of Numeric control and part programming.
- Able to show the elements of an automated manufacturing environment.

Course Contents:

Unit-I : Introduction: Information requirements of mfg. organizations; business forecasting and aggregate production plan; MPS, MRP and shop floor/ Production Activity Control (PAC); Mfg. as a system, productivity and wealth creation; production processes on volume-variety axes; importance of batch and job shop production; CIM definition and CIM wheel, evolution and benefits; CIM as a subset of Product Life Cycle (PLC) mgt; design for mfg. (DFM) and concurrent engg; product design in conventional and CIM environment; terms like CAD, CAE, CAM, CAP, CAPP, CATD and CAQ.

Unit-II: Graphics and standards: Raster scan, coordinate systems for model (M/ WCS) user and display; database for graphic modelling; PDM, PIM, EDM; define EDM, features of EDM; basic transformations of geometry- translation, scaling, rotation and mirror; introduction to modelling software; need for CAD data standardization; developments in drawing data exchange formats; GKS, PHIGS, CORE, IGES, DXF, STEP, DMIS AND VDI; ISO standard for exchange of Product Model data-STEP and major area application protocols.

Unit-III: Geometric Modelling: Its use in analysis and mfg.; 2D and 3D line, surface and volume models; linear extrusion and rotational sweep; Constructive Solid Geometry (CSG); basics of boundary presentation- spline, Bezier, b-spline, and NURBS; sculpture surfaces, classification, basics of coons, Bezier, b-spline and ruled surfaces; tweaking, constraint based parametric modelling; wire-frame Modelling, definition of point, line and circle; polynomial curve fitting; introduction to rapid prototyping.

Unit- IV: Numeric control and part programming: Principles of NC machines, CNC, DNC; NC modes of point to point, -line and 2D, 3D contouring; NC part programming; ISO standard for coding, preparatory functions(G)- motion, dwell, unit, pre-set, cutter compensation, coordinate and plane selection groups; miscellaneous (M) codes; CLDATA and tool path simulation; ISO codes for turning tools and holders; ATC, modular work holding and pallets; time and power estimation in milling, drilling and turning; adaptive control, sequence control and PLC; simple part programming examples.

Unit-V: Group Technology: Importance of batch and job shop production; merits of converting zigzag process layout flow to smooth flow in cellular layout, Production Flow Analysis (PFA) and clustering methods; concept of part families and coding; hierarchical, attribute and hybrid coding; OPITZ, MICLASS and DCLASS coding; FMS; material handling; robots, AGV and their programming; agile

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Computer Aided Process Planning (CAPP), variant/ retrieval and generative approach

References:

1. S.KantVajpay; Principles of CIM; PHI
2. Rao PN; CAD/CAM; TMH
3. Groover MP; Automation, Production Systems & CIM; P.H.I.
4. Rao PN, Tiwari NK, Kundra TK; Computer Aided Manufacturing; TMH
5. Alavudeen A, Venkteshwarn N; Computer Integrated Mfg; PHI
6. Radhakrishnan P, Subramanian S and Raju V; CAD/CAM/CIM; New age Pub

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Perceive the use of computers in engineering field for designing, manufacturing and production of a product.
CO2	Explain geometric transformation methods in CAD and CAD data exchange formats.
CO3	Create mathematical models to characterize curves and surfaces.
CO4	Develop and validate CNC programs to manufacture engineering components.
CO5	Illustrate the elements of an automated manufacturing environment.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	3	2	-	-	-	-	-	2
CO2	3	3	1	1	3	1	-	-	-	-	1	2
CO3	3	2	1	2	3	1	-	-	-	-	-	2
CO4	2	3	2	2	3	2	1	-	1	-	2	2
CO5	1	1	1	-	3	2	2	-	1	-	2	2

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		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
ELECTIVE-V ME8003B	Tribology	70	20	10	-	-	100	3	1	-	4

Course Objective:

To study the basic principles governing the tribology and apply them to reduce friction and wear in mechanical machines and structures.

Chapter 1: Introduction, history of tribology, early scientific studies of - friction, wearand lubrication. Tribo-Surface preparations and characteristics. Surface contacts, Hertz contact stresses, residual stress, surface fatigue, creep, stress relaxation, fracture mechanics, elastic, viscoelastic and plastic behavior of materials. Choice of materials.

Chapter 2: Friction, laws of friction, rolling/sliding friction, theory of adhesion and abrasion, different mechanisms of friction , stick slip characteristics, interface temperature, thermal analysis, Molecular mechanical theory of friction, operating conditions and system parameters, calculations of coefficient of friction, design of friction devices.

Chapter 3: Wear, different types of wear mechanisms, adhesive, abrasive impact,percussion erosion, fretting wear calculations of wear rate, two body/ three body wear, wear prevention, wear of metal cutting and metal forming tools, wear mapping of materials, cavitation, surface fatigue, corrosion, performance levels classifications and specifications of lubricants

Chapter 4: Lubrication, lubricants and additives, composition and properties of lubricants, maintenance of oil and emulsions, industrial hygiene aspects, technical regulations for lubricants. boundary/ mixed and fluid film lubrication, industrial methods of lubrications, SAE,BIS, ASTM, IP, DIN Standards, oil testing's , wear and chemistry of lubricants.

Chapter 5: Nano tribology, Instrumental tests,. Bearings, clutches and brakes, slide units, dynamic seals, Automobile applications, machine tools/ press machines applications. Other applications and case studies.

Evaluation:

Evaluation will be continuous an integral part of the class as well through external assessment.

References:

1. 1. Principles and applications of tribology, Bharat Bhushan, John Wiley& sons, ISBN 0471 594075.
2. Tribology,, - lubrication ,friction and wear, I V Kragelsky and V VAlisin, Mir publication, ISBN 1860582885.
3. Applied Tribology,M MKhonsari and E. R. Booser, John Wiley, ISBN 0471283029.

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Tutorial topics:

1. Testing equipments of tribology.
2. Various industrial applications of tribology.
3. NEMS and MEMS applications
4. Solid, liquid and mist/ gas lubricants.
5. Surface coatings.
6. Chemical analysis of materials
7. Various simulations
8. AFM/ FFM , SFA, STM, studies.

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Infer the basic principles governing the wear, friction and lubrication..
CO2	Examine the different mechanisms of friction and develop friction devices.
CO3	Illustrate the various modes of lubrication.
CO4	Analyze various mechanical machines and structures against wear and friction.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	2	-	-	-	-	-	-	-	-
CO2	1	2	2	1	-	-	-	-	-	-	-	-
CO3	2	-	1	1	-	-	-	-	-	-	-	-
CO4	1	2	2	2	-	-	-	-	-	-	-	-

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
ELECTIVE-V ME8003C	Advance Machining Processes	70	20	10	-	-	100	3	1	-	4

Course Objectives:

- Understand the fundamentals and technologies used in different advance machining processes.
- Apply the characteristics and applications of the product obtained using advanced manufacturing processes.
- Compare different advance machining processes.

Course Contents:

Unit 1: Mechanical processes: Process selection, mechanics of cutting, metal removal rate, cuttingtool system design, ultrasonic machining, abrasive jet machining, water jet machining, effect of parameters and variables, applications and limitations, recent developments in mechanical processes.

Unit 2: Electrochemical and chemical metal removal processes: Electrochemical machining [ECM],elements of ECM, power source and control system, electrolytes, tool work system, chemistry of the process, tool design and metal removal rate, process faults, material removal and surface finish, electrochemical grinding, electrochemical deburring, electrochemical honing, chemical machining.

Unit 3: Thermal metal removal processes: Electric discharge machining[EDM], spark erosion, mechanism of metal removal, spark erosion generator, electrod feed control, vibrating electrode system, dielectric fluid, flushing, accuracy, plasma arc machining[PAM], non thermal generation of plasma, mechanisms and parameters, equipments, electron beam machining[EBM],generation and control of electron beam, theory and process capabilities, neutral particle etching, laser beam machining, hot machining, methods of local heating,tool lie and production rate.

Unit 4: Rapid prototyping fabrication methods: Fundamentals, Technologies, Applications, Principles and working of 3D printing, subtractive v/s additive manufacturing process, VAT photo polymerization, material and binder jetting, continuous liquid inter phase production, direct metal laser sintering.

Unit 5: Technologies of micro fabrication: Types of micro system devices, Industrial applications, micro fabrication processes, LIGA process .Technologies of nano fabrication, importance of size, scanning probe microscope, carbon Buckyballs and nano tubes, nano fabrication processes.

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Books:

1. Mikell P. Groover, Fundamentals of Modern Manufacturing, Wiley India, ISBN 9788126523016
2. Pandey P.C, Shan H.S., Modern Machining Processes, Tata McGraw Hill,ISBN 0070965188
3. Lal G.K,Gupta V, Reddy N.V., Narosa Publishing House,ISBN 8173197091
4. CMTI Handbook

At the completion of this course, students should be able to:

CO1	Explain the fundamentals and technologies used in different advance machining processes.
CO2	Predict the characteristics and applications of the product obtained using advanced manufacturing processes.
CO3	Compare different advance machining processes.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	-	-	-	-	-	-	2
CO2	2	-	2	1	3	-	-	-	-	-	-	1
CO3	3	2	-	1	1	-	-	-	-	-	-	1

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		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
ELECTIVE-VI ME8004A	Energy Conservation & Audit	70	20	10	-	-	100	3	1	-	4

Course Objective

- Understand the concepts of energy management and conservation.
- Able to conduct energy audit and report.
- Concepts of Energy policy its purpose and formation.
- Able to do Electrical Energy Management in different electrical systems.

UNIT-I Energy Management: Concept of energy management, energy demand and supply,economic analysis; Duties and responsibilities of energy managers.
Energy Conservation: Basic concept, energy conservation in Household, Transportation, Agricultural, service and Industrial sectors, Lighting, HAVC.

UNIT-II Energy Audit: Definition, need and types of energy audit; Energy management (Audit) approach: Understanding energy cost, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirement; Fuel & energy substitution; Energy audit instruments; Energy conservation Act; Duties and responsibilities of energy manager and auditors.

UNIT-III Material Energy Balance: Facility as an energy system; Method for preparing process flow, material and energy balance diagrams.
Energy Action Planning: Key elements, force field analysis; Energy policy purpose, perspective, content, formulation, rectification

UNIT-IV Monitoring and Targeting: Definition, monitoring & targeting; Data and information analysis.
Electrical Energy Management: energy conservation in motors, pumps and fan systems; energy efficient motors.

UNIT-IV Thermal Energy Management: Energy conservation in boilers, steam turbine and industrial heating system; Application of FBC; Cogeneration and waste heat recovery; Thermal insulation; Heat exchangers and heat pump; Building Energy Management.

References:

1. Murphy &Mckay, Energy Management, BSP Books Pvt. Ltd.
2. Smith CB; Energy Management Principle, Pergamon Press, New York.
3. Rajan GG, Optimising Energy Efficiency in Industry, TMH.
4. Callaghan P O, Energy Management, McGraw-Hill Book Company.
5. Amit Kumar Tyagi, Handbook on Energy Audit and Management, Tata Energy Research Institute.
6. Bureau of Energy Efficiency, Study material for energy Managers and Auditors: Paper I to V.
7. Hamies; Energy Auditing and Conservation: Method, Measurement..., Hemisphere, Washington.
8. Witty, Larry C, Industrial Enegy Management Utilisation, Hemisphere Publishers, Washington
9. Kreith&Goswami, Energy Management and Conservation Handbook, CRC Press.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Understand the concepts of energy conservation, management and energy efficiency.
CO2	Explain energy audit and preparation of report.
CO3	Examine Energy Management in different electrical/thermal systems.
CO4	Built Material and energy balance diagram and its significance.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	-	2	3	2	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	1	-	-	-	2	-
CO4	-	2	3	2	1	-	-	-	-	-	-	-

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		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
ELECTIVE-VI ME8004B	Production Design	70	20	10	-	-	100	3	1	-	4

Course objective:

- Confidence in your own abilities to create a new product.
- Awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).
- Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective.

Unit -1:

Basic concepts of engineering products' drawings. Software's applications for preparation of drawings, designs and animations.

Unit -2:

Creativity , Concept generation – Intuitive / Rational and as per customers choice amongst alternatives. Needs and wants. Products' specifications and product architecture.

Unit -3:

A brief review of engineering materials and their properties. Concepts of tribology – Friction, Wear and Lubrication

Unit -4:

Basic concepts of limits, fits and tolerances in individual components and assemblies. A brief review of process planning, Jigs, Fixtures, manufacturing methods and shop floor practices. Review of drawings and design from industrial and manufacturing aspects. A brief review of quality assessment and control

Unit – 5:

Basic concepts of ergonomics and related proportions. Value analysis , cost analysis, market impact and feedback data from market to designer. The product life cycle. Intellectual property rights/ Patent procedures and governments' support for export/import substitutions.

Books:

1. K.T.Ulrich and S.D.Eppinger," Product design and development".
2. G.E.Dieter, Engineering Design.
3. Product design – Otto, Wood,

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Course Outcomes:

At the completion of this course, students should be able to

CO1	Create 2D & 3D drawing with the help of CAD software.
CO2	Elaborate a set of tools and methods for product design and development.
CO3	Discuss the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, ergonomics, and production).

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	-	-	-	-	-	-	-	-	1
CO2	-	-	3	2	1	-	-	-	-	-	-	1
CO3	-	-	-	-	-	1	2	1	-	-	2	-

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		End Sem	Mid Sem MST	Quiz, Assignment	End Sem	Lab Work					
ELECTIVE-VI ME8004C	Maintenance Management	70	20	10	-	-	100	3	1	-	4

Course objectives: on the duration of the course student will be able to

1. Understand the concept of maintenance.
2. Classify the types of maintenance.
3. Analyze the methods of restoration.
4. Evaluate failure statics and data.

Course Contents:

Unit-1: Maintenance:definition,preventive,corrective,on-lineoff-linemaintenance,window maintenance,emergency,reconditioning,designoutmaintenance."Product item machine. Plant structure characteristics. Design cost and safety aspects.

Unit-2: Production maintenance system: Maintainability, Maintenance procedures, guidelines for matching procedures to items, universal maintenance procedures. Shutdown programs.

Unit3: Maintenance organization: Workload, resource characteristics, administrative structure, work planning, scheduling and control strategy, feedback, combinations of man power, tools and spares. Documentations. Network planning, computer based management information systems.

Unit -4:Restorationofcomponents:assembly,disassembly bush bearing, housings, Ball and roller bearings, key- splines, couplings shafts-lead screw fittings, clutches-brakes, belt pulley, chain sprocket, guideways, machine hydraulics, pneumatics, electrical works and motors, seals , and packings. Fasteners, welding, machining, repair cycles, repair complexities ,maintenance stages. Lubrication, accuracies and technological test charts.

Unit-5:Failurestatistics:Failure data, failure patterns/statistical models, Failure analysis, applications of different models,Depreciation and average machine life. case studies.

Books:

1.Maintenance management–Handbook,Higgins

2.Maintenance planning and control, AnthonyKelly

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