DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.ACAD/SU/Engg./B.E.& B.Tech./58/2014

It is hereby notified for information of all concerned that, on the recommendations of the Board of Studies in Mechanical Engineering, the **Academic Council at its meeting held on 29-11-2013 has accepted the "Minor changes due to Typographical Mistake in the Third Engineering of the Structure in Mechanical Branch, there is no Marks for Term Work in Paper Code No.MED-324 only practical marks be read 50 instead of 25" and in the "Paper Code No.MED-356 there is no practical for this subject hence, total of practical's comes 10 instead of 12".**

As well as Third Year of B.Tech. in Mechanical Branch, Page No.20 of the syllabus Paper Code No. MED-324 there is no marks for practical & marks of Term Work is 50 instead of 25 under the Faculty of Engineering and Technology. After the above changes both the syllabus are appended herewith.

This is implemented for the **Academic Year 2013-2014** and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF. NO. ACAD/SU/ENGG./2014/
53240-74
A.C.S.A.I.No.78[07]

Date:- 29-03-2014.

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S.B.Zambare

Director,
Board of College and University Development.

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Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.

2] The Director, University Network & Information Centre, UNIC, with **a request to upload this Circular on University Website.**

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [Engineering Unit] Examination Branch,
3] The Superintendent, [Eligibility Unit],
4] The Programmer [Computer Unit-1] Examinations,
5] The Programmer [Computer Unit-2] Examinations,
6] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,
7] The Public Relation Officer,
8] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Revised Syllabus of

THIRD YEAR

B.TECH.

MECHANICAL ENGINEERING

[Effective from the Academic Year 2013-14 & onwards]

FACULTY OF ENGINEERING AND TECHNOLOGY
Proposed Structure |Mechanical| -2013-2014
T.Y. B. Tech. Mechanical

Sub Code	SEMESTER-V	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TW	P	Total	Credits	Duration of Theory Exam
MED-301	Design of Machine Elements-I	3	1	-	4	20	80	-	-	100	4	3 Hrs
MED-302	Theory of Machines-II	3	1	-	4	20	80	-	-	100	4	3 Hrs
MED-303	CAD/CAM/CAE	3	1	-	4	20	80	-	-	100	4	3 Hrs
MED-304	Production Management	4	-	-	4	20	80	-	-	100	4	3 Hrs
MED-305	I C Engines & Turbines	4	-	-	4	20	80	-	-	100	4	3 Hrs
MED-306	Industrial Management	2	-	-	2	10	40	-	-	50	2	2 Hrs
MED-321	Laboratory DME-I	-	-	2	2	-	-	25	25	50	1	
MED-322	Laboratory TOM-II	-	-	2	2	-	-	25	25	50	1	
MED-323	Laboratory CAD/CAM/CAE	-	-	2	2	-	-	25	25	50	1	
MED-324	Laboratory I C E & T			2	2			50		50	1	
MED-325	Seminar	-	-	2	2	-	-	50		50	1	
	Total of semester-V	**19**	**3**	**10**	**32**	**110**	**440**	**175**	**75**	**800**	**27**	

Sub Code	SEMESTER-VI	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	T W	P	Total	Credits	Duration of Theory Exam
MED-351	Design of Machine Elements-II	3	1	-	4	20	80	-	-	100	4	3 Hrs
MED-352	Fluid Mechanics &Machneries	3	1	-	4	20	80	-	-	100	4	3 Hrs
MED-353	Engineering Metallurgy	3	1	-	4	20	80	-	-	100	4	3 Hrs
MED-354	Modern Management Techniques	4	-	-	4	20	80	-	-	100	4	3 Hrs
MED-391-394	Elective-I	4	-	-	4	20	80	-	-	100	4	3 Hrs
MED-355	Computational Techniques	2	-	-	2	10	40	-	-	50	2	2 Hrs
MED-371	Laboratory DME-II	-	-	2	2	-	-	25	25	50	1	
MED-372	Laboratory FP	-	-	2	2	-	-	25	25	50	1	
MED-373	Laboratory Engg Metallurgy	-	-	2	2	-	-	25	25	50	1	
MED-374	Laboratory CT	-	-	2	2	-	-	50	-	50	1	
MED-375	Project-I	-	-	2	2	-	-	50	-	50	1	
	Total of semester-VI	**19**	**3**	**10**	**32**	**110**	**440**	**175**	**75**	**800**	**27**	
	Grand Total of V& VI	**38**	**06**	**20**	**64**	**220**	**880**	**350**	**150**	**1600**	**54**	

L: Lecture hours per week T: Tutorial hours per week P: Practical hours per week CT: Class Test
TH: University Theory Examination TW: Term Work P: Practical/Oral Examination

Elective-I
1. MED-391: Mechatronics
2. MED-392: Reliability & Maintenance Engineering
3. MED-393: Mechanical Vibration 4. MED394. Introduction to aircraft industry and aircraft system

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester-V

Code No.: MED-301	**Title: Design of Machine Elements - I**
Teaching Scheme:	**Class Test (Marks): 20**
Theory : 03 Hrs/week	**Theory Examination (Duration): 3hrs.**
Tutorial : 01 Hr/week	**Theory Examination (Marks): 80**
Credits :04	

Objectives	:	• Understand the meaning of design and design process. • Predict effectively and accurately the reasons of failure and then correlate it to the theoretical knowledge. • Developing the capability to analyze and select the various criteria of design. • Developing creativity for designing the various components such as pins, levers, keys shafts, Couplings, Cotter and Knuckle joint etc. • Developing creativity for designing the various types of fasteners including riveted joints and welding joints at various loading conditions.
Unit-I	:	**Fundamental Aspect of Design** **(A)** The meaning of design, Engineering design, Phases of design, design classification, Aesthetic, Ergonomic & general design consideration, material properties & selection of materials, BIS designation. **(B)** Types of loads and stresses. Stress strain diagram, Factor of safety direct stresses, bending stresses, Necessity of Theories of failure, Two dimensional stress condition, Different theories of failure and combined stresses. Design of C-clamp & C-frame. **[12 Hours]**
Unit-II	:	**(A) Design against static loading:** Design of Cotter joint single and double cotter joint. Design of knuckle joint. Design of lever. **(B) Design of shaft, keys and coupling:** Shafts subjected to bending and torsion, types of keys and their design, design of rigid and flexible couplings. **[10 Hours]**
Unit-III	:	**Design of screw and fasteners:** Design of bolted and threaded joints, design of power screws, introduction to re-circulating ball screw. **[8 Hours]**
Unit-IV	:	**Design against fluctuating load:** Stress concentration, fatigue failure, endurance limit, notch sensitivity, Goodman, Soderberg diagrams, and modified Goodman diagram, fatigue design under combined stresses. **[10 Hours]**

Unit-V	:	**Design of welded and riveted joint:** **(A)** Types of welded joints, eccentrically loaded joints, and welded joints subjected to bending moment. **(B)** Types of riveted joints, Types of failure of riveted joints, Strength equation. Eccentrically loaded joints. **[10 Hours]**
Unit-VI	:	**Design of spring :** Functions, types and spring rate, closed coil helical spring, design equation, Wahl's correction factor, springs in parallel and series, variable loading, effect of end turns, surging of compression springs, leaf springs design equation, construction, extra full length leaves, stress equations. **[10 Hours]**
Reference Books,	:	1. J .E Shigley, Design of Machine Element, TMH Publication 2. M.F. Spotts, Design of Machine Element, Prentice hall 3. Shaum Series, Machine Design, Shaum Series, TMH Publication 4. V.B Bhandari, Machine Design, TMH Publication 5. Pandya and Shah, Machine Design, Charotar Publication 6. S.G. Kulkarni, Machine Design, TMH Publication 7. U.C. Jindal, Machine Design, Pearson
Additional References	:	ASME Journal of Mechanical Design (JMD),NPTEL

Section A: Units I, II, and III; **Section B**: Units IV, V, and VI.

Pattern of Question Paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (MECHANICAL) Semester-V

Code No.: MED-302 | **Title: Theory of Machines-II**
Teaching Scheme | **Class Test (Marks): 20**
Theory : 03 Hrs/week | **Theory Examination (Duration) : 03 hrs.**
Tutorial : 01 Hr/week | **Theory Examination (Marks): 80**
Credits :04

Objectives	:	• Develop ability to come up with innovative ideas. • To make the students aware of Governing system. • To make the students aware of Gyroscope. • To make the students aware of Gear drives used in engineering industry. • To make student able to select suitable gear drives for particular applications. • To make the students aware of Flywheel. • To prepare the students for studying machine design and allied subjects.
Unit-I	:	**Governor:** Principle and working of governors, types of governors such as Watt's,Porter, Proell governors of dead weight type and spring loaded governors of different types. Governor efforts and governor power. Types of governors i.e. stable, unstable, isochronous .Sensitivity of governor, insensitivity caused due to friction at the sleeve. Inertia governors. **[12 Hours]**
Unit-II	:	**Toothed Gearing:** Gear terminology, Types of gears applications, condition of correct gearing, conjugate profiles. Interference& undercutting. Methods of eliminating interference. Path of approach, Path of recess, path of contact, arc of contact & contact ratio, helical gears, its advantages. Herringbone gear. **[12 Hours]**
Unit-III	:	**Gyroscope:** Introduction, Axes and planes of spinning, precession &couple, gyroscopic couple, gyroscopic reactive couple, effect of gyroscopic action on ships, planes, two wheelers & four wheelers. **[06 Hours]**
Unit-IV	:	**Flywheel** Torque-crank angle or turning moment diagrams for different types steam and I.C. engines, fluctuation of energy, function of flywheel, coefficient of fluctuation of energy and coefficient of fluctuation of speed, determination of moment of inertia and/or mass of the flywheel for different applications. **[08 Hours]**
Unit-V	:	**Friction** Sliding friction, laws of dry friction, limiting angle of friction, inclined plane, friction circle, friction axis, friction in screw threads. **[08 Hours]**
Unit-VI	:	**Vibrations:** Introduction causes and effects, natural frequency of vibration of undamped systems having one degree of freedom. Determination of natural frequency of damped spring-mass system. Logarithmic decrement. Obtaining equation of motion for the system for given initial conditions.

		Forced Vibrations: Forced vibration due to constant amplitude Harmonic Excitation, eccentric mass excitation and support excitation Transmissibility, measuring instruments, critical speed of shafts. **[14 Hours]**
Reference Books	:	1. T. Beven, Theory of Machines, Pearson Education India-3rd Edition 2. S.S. Ratan, Theory of Machines, Tata McGraw Hill Education, 3. Shigley, Theory of Machines, McGraw Hill Companies 4. Balaney, Theory of Machines, Khanna Publications 5. R.K.Bansal, A text book of Theory of Machines, Laxmi publications

Section A: I, II and III, **Section B:** IV, V and VI.

Pattern of Question Paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no. 1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (MECHANICAL) Semester V

Code No.: MED- 303

Title: Computer Aided Design/Computer aided Manufacturing/ Computer Aided Engineering

Teaching Scheme:
Theory: 03 Hrs/week
Tutorial: 01 Hr/week
Credits:04

Class Test(Marks): 20
Theory Examination (Duration): 03 hrs.
Theory Examination (Marks): 80.

Objectives	:	• Understanding mathematics, computer representations and algorithms in geometric and solid modeling. • Learning skills in developing fundamental geometric and solid modeling algorithms for CAD/CAM/CAE applications. • To understand the principles of NC technology, problems with conventional NC, to study components of CNC and DNC, understanding the applications of CAD/CAM systems in generating parts programs
Unit-I	:	**Fundamentals of CAD:** Introduction, Basic concepts of manufacturing system and CAD/CAM, Product Life Cycle, Automation and CAD/CAM, Design Process, Application of computers in design: Creating manufacturing database, benefits of CAD, Introduction to Concurrent Engineering. **Computer Hardware;** Graphics terminal, Operator input devices, Graphics output devices, Central processing unit (CPU) **CAD software and Database:** Software configuration of a graphics system: functions of a graphics package, geometric modeling, Database structure and control, Graphics standard: GKS and IGES, STEP **[12 Hours]**
Unit-II	:	**Geometric Transformations:** Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation for translation, rotation, scaling, reflection, shearing, Concatenation of transformation matrices, Homogeneous representation, Application of geometric transformations **Representation of curves and surfaces:** Curve representation, Parametric representation of analytic and synthetic curves, Bezier curves, B-spline curves, Polygon meshed and ruled surfaces, Bezier surface, B-spline surface. **[10 Hours]**
Unit-III	:	**Geometric Modeling:** Wireframe model, solid modeling: solid representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG), Sweeps, volumetric properties, surface modeling, concepts of hidden-line removal and shading, Kinematics analysis and simulation. **Finite Element Method:** Introduction, Finite element procedure, Finite elements, Finite element modeling, Mesh generation. **[08 Hours]**
Unit-IV	:	**NC/CNC Machine Tools:** NC machine tools- basic components, coordinate systems, features of NC machine tools, NC motion control system, NC Procedure, Manual part programming,

		fixed/floating zero. Block format and codes, Computer assisted part programming, problems with conventional NC, Computerized Numerical Control (CNC), DNC and Adaptive Control, Combined DNC/CNC system. **[12 Hours]**
Unit-V	:	**Group Technology (GT) and CAPP:** Part families: parts classification and coding system, Group technology machine cells, Advantages of GT. Introduction and benefits of CAPP, CAPP Approaches: variant, generative and hybrid. **Robotics:** Physical configuration, basic robot motion, technical features of robot, methods of robot programming, introduction to direct and inverse kinematics, forward kinematics using transformation matrices, end effectors, Industrial applications. **[12 Hours]**
Unit-VI	:	**Flexible Manufacturing System (FMS) and Computer integrated manufacturing system:** FMS and its advantages, components of a FMS system, Introduction to CIMS. **Product Life Cycle Management** Introduction, PLM framework, Implementation, benefits, Product data Management **[06 Hours]**
Reference Books	:	1. M.P. Groover and E.W. Zimmers, Jr., CAD/CAM, Prentice Hall of India 2. M. P. Groover, Automation, Production Systems and computer integrated manufacturing, Prentice Hall of India 3. Zeid Ibraham, R. Sivasubramanian, CAD/CAM - Theory and Practice, Tata McGraw Hill Pub Co. 4. P. N. Rao, CAD/CAM Principles and Applications, Tata McGraw Hill Pub Co. 5. Zeid Ibraham, Mastering CAD/CAM, Tata McGraw Hill Pub Co. 6. P. Radhakrishnan, S. Subramanyan, V. Raju, CAD/CAM/CIM, New Age International Publishers
Additional References	:	1. nptel.iitm.ac.in/ 2. ocw.mit.edu/ 3. see.stanford.edu/ 4. Computer-Aided Design (Publisher: Elsevier) 5. Graphical Models (Publisher: Elsevier) 6. Computer Aided Geometric Design (Publisher: Elsevier) 7. Transactions of the Society of CAD/CAM Engineers (Publisher: Society of CAD/CAM Engineers) 8. International Journal of Computer Integrated Manufacturing (Publisher: Taylor and Francis)

Section: A Units I, II, III; **Section** B: Units IV, V and VI

Pattern of Question Paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section

3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester V

Code No.: MED-304
Teaching Scheme:
Theory: 04 Hrs/ week

Credits:04

Title: Production Management
Class Test (Marks): 20
Theory Examination (Duration): 03hrs.
Theory Examination (Marks): 80

Objectives	:	• To equip the students with a strong foundation in logical thinking and thorough knowledge in the production management. • To have thorough understanding about the use of different numerical techniques and to apply them in practical engineering applications.
Unit-I	:	**Introduction:** Concept of Production, Types of production, functions of PPC **Product development and design** Company policy, Effect of competition on design, Types of design, product analysis: marketing, functional ,operational aspects, durability and dependability, aesthetic aspect, economic analysis, profit considerations, effect of simplification, standardization, specification, Break even analysis, production aspects. **[08 Hours]**
Unit-II	:	**Factory planning** Site selection, plant layout : definition, objectives, Flow system-Horizontal and vertical, types of layout: product, process, static product and combination layout, effect of automation on layout, symptoms of bad plant layout. **Demand Forecasting** Introduction, need for demand forecasting, classification of forecasting, numerical on forecasting methods. **[12 Hours]**
Unit-III	:	**Costing:** Elements of cost, overheads-classification, application and apportionment, machine hour rate calculations, cost estimate, depreciation calculation methods, cost centers, determination of selling price. **[10 Hours]**
Unit-IV	:	**Materials management:** Materials management concept, Purchasing or procurement , Purchase organization, buying techniques, quantity & quality standards, Purchasing procedure, accounting, stores and material control, receipts and issue of materials, store records, codification of material, physical verification of stores. **Materials handling:** Need for reduction of materials handling, equipments for material handling, classification and working, selection of material handling equipment, material handling survey check sheet and details, principle of unit load, concept of containerization and palletization. **[12 Hours]**
Unit V		**Human resources management:** Training and recruitment, motivation, wage and salary administration, incentive schemes in Indian industry, job evaluation and merit rating. **[06 Hours]**
Unit VI		**Work Study:** Definition, relationship of work study and productivity, Method study: - Definition, Procedure, recording techniques, Work measurement: - Definition, objectives,

		techniques, procedure, computation of standard time, PMTS, MOST. **[12 Hours]**
Reference Books, e- books, e- Journals	:	1.Elements of Production Planning And Control Samuel Eilon 2.Modern Production / Operations Management Buffa 3.Industrial Engineering & Management O.P. Khanna 4.Cost & optimization engineering F.C. Jelen 5.Introduction to work study I.L.O
Additional Reference Books	:	Motion and time study design and measurement of work Ralph M. Barnes

Section A: Units I, II, and III; **Section B**: Units IV, V, and VI.

Pattern of Question Paper:

The six units in the syllabus shall be divided in two equal parts- sections A and B of 3 units respectively. Question paper shall be set having two sections. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester-V

Code No.: MED-305

Title: Internal Combustion Engines and Turbines

Teaching Scheme:
Theory: 04 Hrs/ week
Credits:04

Class Test (Marks): 20
Theory Examination (Duration): 03hrs.
Theory Examination (Marks): 80.

Objectives	:	Students are expected to understand & analyze the fundamentals and working of Internal Combustion Engines and Turbines to meet the requirements.
Unit-I	:	**Introduction to I C Engine:** Review of IC Engine terminologies, actual valve timing diagram, various losses in actual working, dissociation, specific heats, Selection of Engine. **Carburetion & Fuel Injection:** Introduction, Properties of Air- fuel mixture, Air fuel mixture requirements for steady state and transient conditions. Simple carburetor, complete carburetor. Theory of simple carburetor (approximate & exact analysis), Design of Carburetor. Ideal requirements of carburetor. Air craft carburetor. Introduction to petrol injection system. Requirements of injection system, types of injection system. Bosch fuel pump, Fuel injectors, types of nozzle, Electronic fuel injection system. **[12 Hours]**
Unit-II		**Combustion and Ignition in S.I. & C.I. Engines:** Introduction, Combustion in S.I. Engines, Ignition limits, stages of combustion, effect of engine variables on ignition lag & flame propagation, normal & abnormal combustion, effect of detonation & its control combustion chamber design. Principle Octane rating, HUCR, Combustion in C.I. Engines: Stages of combustion, delay period, diesel knock & its control, cetane rating, Air-fuel ratio, Design of combustion chamber. Ignition System: Ignition System Requirements, Battery & Magneto Ignition Systems, Comparison & Problems. Electronic Ignition system, Spark Advance 1& Retard System. Exhaust emissions coming out of I.C. engine exhaust, effect on human health. Causes of formation. Pollutants measurements & abetment. **[12 Hours]**
Unit-III	:	**Testing and Performance :** Introduction, Performance parameter and their measurement- Morse Test, BP, FP., Heat balance sheet, performance characteristics of S.I. & C.I. Engines, Performance maps ,numerical. **[06 Hours]**
Unit-IV	:	**Steam Turbines:** Introduction classification advantages of turbines, Impulse & Reaction turbines, compounding of steam turbines, velocity diagrams, work done on turbine blades, turbine efficiency, and losses in steam turbines, degree of reaction. Governing of steam turbines- throttle governing, bypass governing & nozzle control governing,

		Numerical. **[10 Hours]**
Unit-V	:	**Gas Turbines:** Introduction, Brayton/Joule cycle, Open Gas Turbine Cycle with Intercooling, Reheat and Regeneration, and their effects on efficiency, comparison of open Cycle and Closed Cycle. Gas turbine combustion chamber, performance of turbine with blade material and lubrication, maintenance and troubleshooting ,Numerical. **[10 Hours]**
Unit-VI	:	**Supercharging:** Introduction, Objectives & principles of supercharging, Methods of Supercharging, Supercharging Limits, Modifications for supercharging, Advantages & limitations, Turbo charging. **Recent Trends in I. C. Engines** Direct Injection systems: MPFi, CRDi; Variable valve timing systems: VTEC Engine, Valvetronic system, Alternative Fuel Engines. **[10 Hours]**
Reference Books:	:	1. Edward Obert, Internal Combustion Engines & Air pollution, Harper & Row Publications. 2. Richard Stone, "Introduction to Internal Combustion Engines", SAE International. 3. John B Heywood, "Internal Combustion Engines Fundamentals", McGraw-Hill,Inc. 4. Mathur & Sharma; "Internal Combustion Engines , Dhanpat Rai & Co 5. Dr. V. Ganeshan, "Internal Combustion Engines", T.M.C 6. Dr. V.M. Domkundwar, "Internal Combustion Engines", Dhanpat Rai & Co. 7. R.Yadav, "Steam & Gas Turbines", Central Publishing House 8. R.K. Rajput, "Thermal Engineering"Laxmi Publications. 9. H N Gupta, "Fundamentals of I.C. Engines" Prentice Hall, India 10. Willard W Pulkrabek., "Engineering fundamentals of Internal combustion Engines" Prentice Hall, India.
Additional Reference Books	:	---

Section A: Units I, II, and III; **Section B**: Units IV, V, and VI.

Pattern of Question Paper:

The six units in the syllabus shall be divided in two equal parts- sections A and B of 3 units respectively. Question paper shall be set having two sections. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester V

Code No.: MED- 306
Teaching Scheme:
Theory: 02 Hrs/ week
Credits:02

Title: Industrial Management
Class Test(Marks): 10
Theory Examination (Duration): 02 hrs.
Theory Examination (Marks): 40.

Objective	:	• To understand concept of Management, Administration, Organization, Industrial Law, Financial Management.
Unit-I	:	**Introduction to Management:** Managing and manager, organizations and the need for management, the management process, types of managers, the challenge of management, the evolution of management theory. **[03 Hours]**
Unit-II	:	**Management in the Twenty-First Century:** The importance of organizational and natural environment, elements of the direct action environment, managing multiple stock holder relationship, elements of the indirect action Environment, Natural environments, management 2000 and beyond, social responsibility and ethics, globalization and management. Evaluation of Case studies related to above concepts. **[03 Hours]**
Unit-III	:	**Business Organization:** Forms of business organization, individual proprietorship, joint stock company, co-operative enterprise and public sector undertakings. Organization structures in industries, line organization, functional organization, line and staff organization, committee organization, project organization, matrix organization. **[04 Hours]**
Unit-IV	:	**Nature and Significance of Economics:** Science, Engineering and technology their relationship with economic development. Basic economic concepts, human wants-economic goods, utility, value, price, cost, wealth and capital. Demand, supply, Elasticity of demand and supply. Concept of profit and revenue. **Financial Management:** Concept of management, accounting systems, financial accounting and cost accounting system, sources of industrial finance, sales organization of a firm, management of sales and advertisement, market research. **[09 Hours]**
Unit-V	:	**Accidents and Safety** Classification of accidents; according to nature of injuries i.e. fatal, Temporary; according to event and according to place. Causes of accidents-psychological, physiological and other industrial hazards. Effects of accidents. Accidents-prone workers. Action to be taken in case of accident with machines, electric shock, road accident, fires and erection and construction accidents. **Industrial Act:**

		Industrial, Factory act, pollution control, industrial safety, introduction to causes of accidents, safety, accident prevention techniques and related legal provisions. **[07 Hours]**
Unit-VI	:	**Personnel Management:** Man power, sources of recruitment, selection and training, job evaluation, performance appraisals, wages and incentives, self and time management. **[04 Hours]**
Suggested Text Books and References	:	1. James A.F.Stoner, Management, PHI 2. C.S. George Jr, Management for Business and industry 3. Mc Connel,Gupta, Economic principles, problems and polices, TMH 4. T.R Bange and S.C.Sharma, Industrial organization and Engineering Economic, Khanna Publication 5. O. P. Khanna, Industrial Management 6. Knootz & O'Donnell, Principles of Management 7. M.C.Shukla, Business organization & Management 8. G.D. Stervens, Engineering Economics

Section A: Units I, II, and III; **Section B:** Units IV, V, and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 40 marks Paper:

1. Minimum eight questions
2. Four questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for six marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 7 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester-V

Code No.: MED-321	**Title: Laboratory of Design of Machine Elements - I**
Teaching Scheme:	**Practical (Marks) : 25**
Practical : 02 Hrs/ week	**Teachers assessment (Marks): 25**
Credits :01	

Course Objective		After successful completion of course students shall able to design mechanical joints, couplings, power screw and clamps
List of Practical not less than ten	:	**A. Three full imperial sheets on following:** 1. Design and Drawing sheet (Details and assembly) on any two of the following : Cotter Joint, Knuckle Joint, Lever loaded safety valve or spring loaded safety valve 2. Design and Drawing sheet(Details and assembly) on any one of the following : Rigid or Flexible coupling, Bolted or welded joint subjected to eccentric loading. 3. Design and Drawing sheet(Details and assembly) on any one of the following : Screw jack, C- Clamp **B. Assignments on following topics :** 1. Design process, Aesthetic and Ergonomic Consideration in Design. Design considerations 2. Selection of Material, Theories of failure, Fatigue Loading, Design of Power Screw, Springs

Assessment of term work shall be done on the basis of following

- Continuous assessment
- Performing the experiment in the laboratory
- Oral examination conducted on syllabus and term work mention as above

Practical Examination: The practical Examination shall consist of via-voce based on syllabus and term work. The assessment will be based on

- Record of term work submitted
- Via-voce on the syllabus

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Mechanical) Semester-V

Code No.: MED-322

Teaching Scheme

Practical : 02 Hrs/ week

Credits :01

Title: Laboratory of Theory of Machines-II

Practical (Marks) : 25

Teachers assessment (Marks): 25

Course Objectives	:	
List of Practical	:	**Term work shall Consists of record book on laboratory experiments studies on the following.** 1. Plotting controlling force diagram for porter governor 2. Plotting controlling force diagram for Hartnell governor 3. Study of gyroscopic effect and finding moment of inertia of the gyroscopic disc 4. Study Interference and undercutting of gears and generating gear tooth profile. 5. Determine the radius of gyration of a given compound pendulum. 6. Determine the radius of gyration of a given bar using bifilar suspension. 7. Determine the natural frequency of undamped vibrations of spring mass system. 8. Finding natural frequency of single rotor system. 9. Finding natural frequency of double rotor system. 10. Determining the radius of gyration of a given bar using trifilar suspension. 11. Study of critical speed of shafts.

The assessment of term work shall be on the following criteria:

- Continuous Assessment
- Performing the experiments in the laboratory
- Oral examination conducted (internally) on the syllabus and the term work mentioned above

Practical Examination:

The practical examination shall consist of performing an experiment based on the practical work done during the course, the record of the experiments submitted by the candidate and Viva-voce based on the syllabus

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of S. Y. B. Tech. (Mechanical - Semester-V)

Code No: MED-323		**Title: Computer Aided Design/Computer aided Manufacturing/ Computer Aided Engineering**
Teaching Scheme: 02 Hrs/ week **Practical : 25 Marks**		**Teachers Assessment: 25 Marks** **Credits: 01**
Course Objectives	:	• To introduce to CAD software systems designed for geometric modeling of engineering components and systems. • To understand the basics of NC-machine tools, and manual and computerized part programming and to implement CNC programs for milling and turning machining operations.
List of Practicals	:	1. Part modeling using some of the modeling technique (2-D) 2. Part modeling using some of the modeling technique (3D) 3. Component details and assembly in CAD using modeling software 4. Analysis of a component using any one analysis software 5. Part-programming on CNC Lathe machines 6. Part-programming on CNC Milling machines 7. Case study based on GT, CAPP and PLM 8. Report based on industrial visit.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above

Corrected Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical- Semester-V)

Code No: MED-324 — **Title: Internal Combustion Engines and Turbines.**

Teaching Scheme: 02 Hrs/ week — **Teachers Assessment:**

Practical : — **Credits: 01**

Term Work: 50 marks

Course Objectives	:	To deal effectively with practical engineering situations, including analysis, selection and performance, and design of Internal Combustion Engines and the equipments associated with it.
List of Practical's	:	1. Trial on Diesel Engine with variable load & constant speed. 2. Trial on Diesel Engine with variable speed & constant load. 3. Trial on Petrol Engine with variable load & constant speed. 4. Trial on Petrol Engine with variable speed & constant load. 5. To draw the actual Valve Timing diagram for a given engine. 6. Dissembling & Assembling of the given Carburetor. 7. Morse Test. 8. Study of different types of fuel injection systems 09. Study of different types of carburetors. 10. Study of any one automobile engine with reference to characteristics. 11. Assignment on Exhaust Emission.
		Note: Term work shall consist of performing minimum of eight experiments from the list and preparing a record of these experiments and assignments.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester-V

Code No.: MED-325
Teaching Scheme
Practical : 02 Hrs/ week
Credits :01

Title: Seminar
Teachers assessment (Marks): 50

Objective:

1. To create awareness amongst pre final year students for latest technological Aspects.
2. To improve presentation and communication skills.
3. To inculcate qualities of team work and team spirit.
4. To motivate for research work in the respective areas.
5. To have common platform where interaction between various groups of students will take place on the various advanced and emerging topics of technology.
6. To improve skills related to search on the internet.
7. To realize importance of basic technological aspects.

Guidelines for students and faculty:

Seminar topics may be chosen by the students with advice from the guide/Industry persons, which shall be finalized by guide and approved by concerned head of the department. Students are to be exposed to the following aspects of the seminar presentation.

a) Literature Survey / Review
b) Organization of the material
c) Preparing for presentation
d) Technical writing

1. Each student is required to-
   a. Submit one page synopsis before the seminar talk for display on the notice board and
   b. Give a 20 minutes presentation through OHP, PC, and Slide projector followed by a 10 minute question answer session.
2. For award of Sessional marks:
   a. 25 marks - based on the assessment done by internal guide during semester and the involvement of student in the work assigned related to the seminar topic

b. Remaining 25 marks based on the examination at final presentation. Student is to be examined on the basis of an oral and written presentation by at least two examiners, one of them shall be guide and other as an external examiner appointed by the principal of the institute.

Seminar Report Format

The Seminar Report shall be typed on A-4 size white bond paper.

Typing shall be with spacing of 1.5 using one side of the paper.

Margins:-

- Left 37.5 mm
- Right, top and bottom 25 mm.

Binding: -

- Hard with golden embossing on the front cover of brown colour

Front cover of hard bound report:-

It should be identical to first title page.

Default font size TNR-12

1) Format for title page (First Page) (Centre justified)

Report of Seminar (TNR-14, Bold)

in

{Title}(TNR-18, Bold)

by

{Name of student}(TNR-16, Bold)

(Roll No:)

Submitted in partial fulfillment of the requirement for

Degree of Bachelor of Technology (Branch Name) (TNR-14, Bold)

of

Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad. (TNR-14, Bold)

Department of Mechanical Engineering, (TNR-14, Bold)

Maharashtra Institute of Technology, (TNR-16, Bold)

Aurangabad. (TNR-14, Bold)

200 - 200

2) Format for Certification page (Second page)

CERTIFICATE (TNR-16, Bold)

This is to certify that the Seminar Report

Submitted by

(Name of Student) (TNR-14, Bold)

(Roll No: __)

Is completed as per the requirement of the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad in partial fulfillment of

Degree of Bachelor of Technology (Mechanical Engineering) (TNR-14, Bold)

For the academic Year 20__ - 20__

(Name)	(Name)	(Name)
Guide	Head of Department	Principal (TNR -12, Bold)

3) The third page will be certificate issued by the industry regarding the completion of Seminar if applicable.

4) The fourth page would be for acknowledgement, which would be followed by index page (Fifth page).

5) Sketches should be drawn on separate sheet (minimum A4 size) and be inserted at proper places. The sketches should be drawn in black ink and be numbered.

6) Tables should preferably type in the text only.

7) The mathematical symbol should be typed or neatly written so as to match darkness of the text.

8) The last item on the index should be references.

9) Page number must appear on the right hand top corner of each page starting after index page.

10. The contents of the seminar can be decided by the internal guide / department and student.

11. Minimum number of copies = 5 Copies (Central Library + Department + Internal Guide + External Examiner + Student). The copy of External Examiner will be submitted by the student after completion of Seminar.

General Attributes

- Chapter heading -All Capital—TNR 14 Font (Bold)
- Heading –All Capital- TNR 12 Font (Bold)
- Subheading–Title case- TNR12 Font (Bold)
- Text – TNR11 Font
- Title of the Report should not be more than two lines
- Page numbers are at right hand corner at ½ inch from right and top side.
- Page number should be allotted only from Chapter no. 1 onwards.

References

Last chapter of the report is references including the addresses of websites.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad **(Faculty of Engineering & Technology)** **Syllabus of T. Y. B. Tech. (Mechanical) Semester- VI** **Code No.: MED-351** **Title: Design of Machine Elements - II** **Teaching Scheme:** **Class Test (Marks): 20** **Theory : 03 Hrs/week** **Theory Examination (Duration) : 3 Hrs** **Tutorial : 01 Hr/week** **Theory Examination (Marks): 80** **Credits :04**		
Objectives	:	• Understand the procedure of gear design and gear trains. • Predict effectively and accurately the reasons of failure and then correlate it to the theoretical knowledge. • Developing the capability to analyze and select the various criteria of design. • Developing creativity for designing the various components such as bearing, Shaft, key, Brakes, clutches and Belt, rope Chain Drive.etc. • Understand the basic concepts of Statistical Consideration, Optimum Design and Standardization.
Unit-I	:	**Introduction to Gears:** Design considerations of gears, material selection, types of gear failure. **a) Spur Gear:** Terminology, Gear tooth loads, force analysis, beam strength (Lewis equation) equation, dynamic tooth load (spot's & Bucking ham's equation) wear strength (Bucking ham's equation), **b) Helical Gears:** Terminology, Force analysis, Formative number of teeth in helical gears, beams & wear strength of helical gears, effective load & design of helical gear. **c) Bevel Gear:** Terminology, Force analysis, Formative number of teeth, Design of bevel gears based on beam and wear strength. **d) Worm Gears:** Terminology. Standard dimensions and recommendation of worm gearing, Force analysis, Formative number of teeth, Design of worm drive as per AGMA Recommendation. **[18 Hours]**
Unit-II	:	**Gear train-** Introduction, Types of gear train, simple, compound, reverted and Epicycle gear train. **[04 Hours]**
Unit-III	:	**Design of friction clutch:** Introduction, types & friction materials. Design of single & multi-plate clutch. Design of cone clutch. Design of centrifugal clutch. **[08 Hours]**

Unit-IV	:	**Design of belt: Introduction,** types & materials. **a) Flat belt:** Length of belt (opens & cross), slip & creep belt, velocity ration, centrifugal tension. initial tension, ratio of limiting tension , stresses in belt, condition for maximum power b) **V-belt :** Construction of V-belt , ratio of limiting tension, selection of V-belt from manufacture catalogue **C) Chain & rope drive:** Introduction **[14 Hours]**
Unit-V	:	**Design of bearings :** **A) Introduction to Tribological consideration in design:** Friction, Wear, Lubrication. **B) Sliding contact bearing :** Basic theory, thick and thin film lubrication, Newton's law of viscosity, Petroff's equation , Sommerfield Number , Reynolds's equation, Raimondi and Boyd method relating bearing variables, Heat balance in journal bearings, Temperature rise. Introduction to hydro static bearings. **C) Rolling Contact Bearing:** Types, static and dynamic load capacities, Stribeck's equation. Equivalent bearing load, load-life relationship, bearing life, load factor, Selection of bearing from manufactures catalogue. Design for variable load and speed, Bearings with probability of survival other than 90 %. **[14 Hours]**
Unit-VI	:	**Optimum Design & Statistical Consideration:** Only Introduction **Standardization**: Only Introduction. **[02 Hours]**

Reference Books :

Sr. No.	Title	Author	Publication	Edition
1	Design of machine element	J .E Shigley	TMH Publication	
2	Design of machine element	M.F. Spotts	Prentice hall	
3	Machine Design	Shaum Series	TMH Publication	
4	Machine Design	V.B Bhandari	TMH Publication	
5	Machine Design	Pandya and Shah	Charotar Publication	
6	Machine Design	U.C.Jindal	Pearson	
7	Machine Design	S.G. Kulkarni	TMH Publication	

Additional Reference Books, Digital References	:	ASME Journal of Mechanical Design (JMD),NPTEL

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

5. Minimum ten questions
6. Five questions in each section
7. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
8. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester- VI

Code No.: MED-352

Teaching Scheme:

Theory : 03 Hrs/week
Tutorial : 01 Hr/week
Credits :04

Title: Fluid Mechanics and Machineries
Class Test (Marks): 20
Theory Examination (Duration) : 3 Hr
Theory Examination (Marks): 80

Objective	:	This course aims at developing an understanding of discharge, fluid flow & hydraulic machines & analytical abilities for the same.
Unit-I	:	**Flow Through Orifices:** Introduction, Classification of orifices, Flow through an orifice, Hydraulic Coefficients, Experimental Determination of Hydraulic Co-efficient, Discharge through a large rectangular orifice, Discharge through fully submerged orifice, Time required for emptying a tank through an orifice at its bottom. **[08 Hours]**
Unit-II	:	**Flow Around submerged bodies- Drag & lift:** Introduction, Force exerted by a flowing fluid on a body, Expressions for Drag & Lift, Dimensional analysis of Drag & Lift, Drag on a sphere, Terminal velocity of a body, Applications of Stokes Law, Drag of a cylinder, Circulation & Lift on a circular cylinder, Flow patterns & development of lift, Position of Stagnation points, Pressure at any point on the cylinder surface, Expression for lift on the cylinder (Kutta-Joukowski Theorem), Expression for lift co-efficient for rotating cylinder, Magnus effect, Lift on an airfoil. **[12 Hours]**
Unit-III	:	**Dimensional Analysis and similarity:-** Dimensions of various physical quantities, Rayleigh's method, Buckingham's π Theorem, Types of similarities, Distorted and non distorted models, Dimensionless numbers and their significance. **[10 Hours]**
Unit-IV	:	**Impact of Jets:** Introduction, Force exerted by jet on stationary vertical plate, Force exerted by a jet on stationary inclined plate, Force exerted by a jet on stationary curved plate, Force exerted by jet on moving plates (Flat vertical plate moving in the direction of jet & away from jet; Inclined plate moving in the direction of the jet; Curved plate moving in the direction of the jet, Force exerted by a jet on an unsymmetrical moving curved plate when jet strikes tangentially at one of the tips; Force exerted by a jet on series of vanes; Force

		exerted on a series of radial curved vanes) **[08 Hours]**
Unit-V	:	**Hydraulic Turbines:-** Introduction, Classification, Tangential flow impulse Turbine, Construction & working of pelton wheel, Work done & efficiency of a pelton wheel, Definition of heads & efficiency, Design aspects of pelton wheel, Radial flow Reaction Turbine, Construction & working of Francis turbine, Design of a Francis turbine runner, Axial flow reaction turbine, Propeller Turbine, Kaplan Turbine, Runway speed, Draft Tube, Draft tube Theory, Types of draft tubes, Specific Speed, Unit Quantities, Performance Characteristics of Hydraulic Turbines, Cavitations. **[12 Hours]**
Unit-VI	:	**Centrifugal Pump** Introduction, Construction & Working of C. P. Work done by the impeller on water, Definition of Heads & efficiencies of C. P. Losses in C. P. Minimum Speed for Starting a C.P., Effect of variation of Discharge on efficiency, Effect of no. of vanes of impeller on head & efficiency, Multistage C.P., Pumps in Series, Pumps in Parallel, Specific speed, Model testing & geometrically similar Pumps, Characteristics of C.P, NPSH, Cavitations, and Priming **[10 Hours]**

Text Books and References :

Sr. No.	Title	Author	Publication	Edition
1.	Fluid Mechanics & Hydraulic Machines	R.K.Bansal	Lakshmi Publication Pvt. Ltd. Co.	
2.	Fluid Mechanics & Hydraulic Machines	R.K.Rajput	S. Chand co. publications	
4.	Fluid Mechanics & Fluid power Engineering	D.S. Kumar	S.K. Kataria & Sons Delhi.	
5.	Fluid Mechanics	Streeter V.L.& Wylie E.B.	Tata McGraw-Hill International	
6.	Hydraulic Machines	Jagdish Lal	Metropolitan Book Co. Pvt. Ltd.	
7.	Hydraulics, Fluid Mechanics & Fluid Machines	Ramamurtham	Dhanpat Rai & Son's	
8.	Engineering Fluid Mechanics	K.L. Kumar	Eurasia Publishing House Pvt. Ltd.	
9.	Theory & applications of Fluid Mechanics	Subramanian K.	Tata McGraw-Hill Publishing Co. Ltd.	
10.	Fluid Machines	Modi & Seth		

Section A: Includes Unit I, II and III; **Section B:** Includes Unit IV, V and VI.

Pattern of Question Paper:

The six units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

9. Minimum ten questions
10. Five questions in each section
11. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
12. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester-VI

Code No.: MED-353	**Title: Engineering Metallurgy**
Teaching Scheme:	**Class Test (Marks): 20**
Theory: 03 Hrs/week	**Theory Examination (Duration): 03 hrs.**
Tutorial: 01 Hr/week	**Theory Examination (Marks): 80.**
Credits:04	

Objectives	:	• Introduce students to the field of materials science and materials testing. • To study phase diagrams, application & effect of alloying elements on the microstructure and properties of different types of ferrous alloys. • To understand principle of various Heat Treatments. • To understand the Fundamentals of Alloy Steels.
Unit-I	:	**Mechanical Engineering properties and structure of metals** Principle and measurement of Mechanical Engineering properties like hardness, Tensile strength, Impact strength, Creep, Toughness, Resilience, Ductility, Fatigue and Wear. Relevance of properties in selection of materials for Engineering applications. ASTM standards and their relevance. **Crystallography and Microscopy** System of crystal lattices, Space lattice, Unit cell, Coordination number, packing efficiency, Imperfections/Dislocations/ Defects in crystal structure and their significance. Material characterization and characterization methods using optical, X-ray and electron scanning method. **[12 Hours]**
Unit-II	:	**Equilibrium Diagrams:** Concept of solid solutions, Hume Rothery rules. Solidification of pure metals and an alloys, cooling curves, phase, Modified Gibbs phase rule, Construction of phase diagram, Study of Isomorphous, Eutectic, peritectic, Monotectic and Eutectoid systems. Lever rule and its use. **[08 Hours]**
Unit-III	:	**Iron-Carbon phase Diagram** Iron-Iron carbide equilibrium diagram, Phases in Fe-C diagram, Invariant reactions, Critical temperatures, Micro constituents and their definitions, microstructures of various alloys of iron and carbon. Plain carbon steels, structure properties co-relationship of PC steels, concept of equilibrium cooling rates, Lever rule and it's applications to steel portion of diagram. Classification of steels, Specification of steels. **Non Equilibrium cooling** Effect of Non Equilibrium cooling on Fe-C diagram, Construction of TTT diagram and labeling, Critical cooling rate, Transformation products of

		Austenite, Characteristic of Martensite and bainite. **[10 Hours]**
Unit-IV	:	**Heat Treatment of steels** Necessity of Heat Treatment, Heat Treatment furnaces, Salt baths in Heat treatment, Heat treatment of plain carbon steels, Annealing and it's types, Normalizing, Hardening, Tempering. Cooling media, Heat removal mechanism, Retained austenite and its effect, Cryogenic treatment, Polymer quenching. Hardenability, Jominy End Quench Test, Significance of Hardenability, Austempering, Martempering, Patenting and Ausforming of steels. **Case Hardening methods**- Case hardening, Carburizing- solid, liquid and gas, Nitriding, carbonitriding, Defects in heat treatment and their remedies. **[12 Hours]**
Unit-V	:	**Alloy Steels** Classification of Alloying elements, effect of Alloying elements on Fe-C and TTT diagram, Classification of steels on the basis of composition and uses, Study of steels like Mild steels, Tool steels, HSS, HCHC, Micro-alloyed steels, Spring steels, Ball bearing steels, HSLA steels, Trip Steels, Free cutting steels, Stainless steels, Classification, Uses, Specifications – Need, Indian standards, AISI, En series, BS standards etc. **[09 Hours]**
Unit-VI	:	**Cast Irons** White cast iron, effect of presence of silicon in cast irons, Maurers diagram, Classification of cast irons, Effect of shape, size and distribution of graphite on the properties of cast irons, Grey CI, Mehanite, Malleable CI, Nodular CI, their manufacture, properties and applications. **Non –ferrous metals and alloys** Study of phase diagrams, types, Application and heat treatment of the following important cast and wrought alloys-Aluminum alloys, copper alloys, bearing metals. **[09 Hours]**
Reference Books:	:	1. Sydney H Avner, Introduction to Physical Metallurgy, Tata McGraw Hill (Second edition) 2. B.K.Arawal, Introduction to Engineering Metallurgy, Tata McGraw-Hill 3. R. Higgins , Engineering Metallurgy 4. William D. Callister , **Material Science and Engineering**: An Introduction, Wiley & Sons Inc (Sixth edition) 5. V. D. Kodgire,Material science and Metallurgy, Everest Publishing House
Additional Reference Books	:	1. ASTM Handbooks

Section A: Includes Unit I, II and III; **Section B:** Includes Unit IV, V and VI.

Pattern of Question Paper:

The six units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical Engineering) Semester- VI

Code No: MED-354 | **Title: Modern Management Techniques**
Teaching Scheme: 04Hrs/week | **Class Test (Marks) : 20**
Theory: 04Hrs/week | **Theory Examination (Duration): 03 Hrs**
Credits:04 | **Theory Examination (Marks): 80**

Objectives	:	1. To understand the concepts of modern management to enhance creativity 2. To understand the significance of thinking & its effective usage in productivity Improvement.
Unit-I	:	**Value Engineering:** Value-types, Value analysis, Value Engineering, Value Control, FAST analysis, DARSARI method. **Methods Engineering:** Continuous method improvement, waste, type of waste elimination. KAIZEN Improvement versus Innovation, Finding & Implementing improvements-PDCA cycle, Five -Why Process. Process Reengineering. Ensuring Correct method of working POKAYOKE. Workplace layout & work station design, single minute exchange of dies, material handling system. **[12 Hours]**
Unit-II	:	**Just in Time:** Introduction, push and pull system, features of JIT, advantage-reduced inventories, improved set-up times, JIT applied to Indian scenario, Kanban, types of Kanban Toyota Production System, Concept of flexible manufacturing cell. **Lean Manufacturing:** Introduction Definition, distinctive features, mall-Lot Production, setup-time Reduction, Maintaining and Improving Equipment .Pull production system .Focused factories and group technology, work cells and Cellular manufacturing Standard Operation., Lean Maintenance. **[12 Hours]**
Unit-III	:	**Manufacturing Systems** Agile Manufacturing: Definition, business need, conceptual frame work, characteristics, generic features. Reconfigurable Manufacturing: Introduction, Definition, Comparison of Manufacturing Systems, Historical Perspective, Future Trends, Technologies for Reconfigurable Machining Systems. **[06 Hours]**
Unit-IV	:	**Total Productive Maintenance:** Introduction, Definition, Distinctive features, Four development striving for overall equipment effectiveness, the five TPM development activities the twelve steps of TPM, stages of TPM development. **[06 Hours]**
Unit-V	:	**Supply Chain Management:** Introduction, Decision Phases in Supply Chain, Process view of a supply chain importance of supply Chain Flows. New Customer –Supplier relationship –Supplier selection, purchasing, JIT in Supply Chain, E-Business and the Supplier Chain., Green

		Supply Chain Management. **Management Information System** Data, Information, Needs of computer based introduction system Definition & concept of MIS and Data processing, need of database, Role of MIS in organization Impact of MIS on function of organization. **[12 Hours]**
Unit-VI	:	**Mechanism of Mind:** Introduction, Mechanisms of mind, Types of thinking, vertical Thinking Parallel Thinking, Practical Thinking Techniques, Six thinking hats, Six thinking shoes. **Transactional Analysis:** Introduction, ego states, Parent, Child, Adult, Types of Communication-Parallel, Cross Communication, JOWHARI windows **Decision Making:** Introduction, Decision making condition, Decision making process, Decision making tools –Quantitative Tools, Quantitative Tools. **(12 hrs.)**
Reference Books:	:	

Sr. No	Title	Author	Publication
1.	Competitive Manufacturing management	John M. Nicholas	TMH
2.	Mechanisms of Mind	Edward De Bono	
3.	Six Thinking Hats	Edward De Bono	
4.	Six Thinking Shoes	Edward De Bono	
5.	I'M OK You are OK	Thomas Harrison	
6.	Supply Chain Management	Sunil Chopra, Peter Meindl	Pearson Education
7	Techniques of Value Analysis & Engineering	I.D. Miles	
8	Kaizen	Masaaki Imai	
9.	Pokayoke	Hiroyuki Hirmaao	Productivity Press, Cambridge
10.	Management Information System	W.S. Jawadekar	TMH
11.	Management Information System	Raja Raman	
12	Management Information System, Conceptual foundation, Structure & Development	Garden Bdevis and Margrath H. Olson. MGH	

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions.
2. Five questions in each section.
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (MECHANICAL) Semester-VI

Code No.: MED-391
Teaching Scheme:
Theory: 04 Hrs/week
Credits:04

Title: Mechatronics[EL-I]
Class Test (Marks): 20
Theory Examination (Duration): 03hrs.
Theory Examination (Marks): 80.

Objectives	:	• To study need and application of Mechatronics • To study Mechatronics system components • To study interfacing of various components in Mechatronics system • To understand basic terminologies and concepts associated with Mechatronics • To study various Mechatronics sub-systems • To understand interfacing concepts, Electro Mechanical Systems and the related terms.
Unit-I	:	**Introduction and Mechatronics system model Introduction** to Mechatronics system Element of Mechatronics system-mechanical system (sensor/actuators) signal conditioning, data acquisition, micro controllers. Role of each component in working of the system. Computer Integration of Electro-Mechanical System, Virtual Instrumentation and Computer Monitoring and control. Basics solid state components and devices, elements of electromechanical energy conversion, starting, inversion and control of electrical drives, coupling of mechanical loads to DC and AC electrical drives and speed control **[10 Hours]**
Unit-II	:	**Sensors and Signal Conditioning:** Definition and Classification, Principle, construction and working of: Linear and rotational sensors,Acceleration sensors,Force measurement,Temperature measurement, Distance measurement and proximity sensors,Vision sensor,Need of signal conditioning, Instrumentation amplifiers, OP-AMP (S/I/D/A),Digital filters. **[16 Hours]**
Unit-III	:	**Data Acquisition:** Analog to digital conversion, resolution and quantization, A to D conversion, D to A conversion, Introduction to micro controllers and microprocessors use of micro controllers and microprocessors in Mechatronics, micro controller 8051 architecture, pin configuration, Design of real time Data Acquisition system. **[10 Hours]**
Unit-IV	:	**Actuators & Display devices:** Electro-mechanical Actuators, Electrical Machines (Stepper & servo motors), Piezoelectric actuators, Hydraulic & Pneumatic actuation system, MEMS actuators, LED, LCD, Buzzers, Alarms, Annunciators. **[08 Hours]**
Unit-V	:	**Programmable Logic Controller(PLC):** Introduction-Basic structure, Input/Output Processing-Programming, Ladder Diagrams, Mnemonics-Timers, Internal relays and counters, Data handling, Analog Input/Output **[08 Hours]**
Unit-VI	:	**Mechatronics System Design:** Case study (Robotics/Nanotechnology/Automobiles): Definition of problem, Design of Mechatronics system, Selection of sensor, Selection of actuator, Selection of a PLC, Selection of Digital processor and signal conditioning

		elements **[08 Hours]**
Reference Books: Additional Reference Books	:	1. David G. Alciator, Michal B. Histand, Introduction to mechatronics and measurement system 2. Mechatronics, HMT 3. Curtis Johnson , Process Control Instrumentation Technology 4. Kenneyth J Ayayla , The 8051 Microcontroller Architecture, Programming and Application , Penram International Publication. 5. Krishna Kant, Computer based Industrial Control

Section A: Includes Unit I, II and III; **Section B:** Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (MECHANICAL) Semester VI

Code No.: MED-392
Teaching Scheme:
Theory: 04 Hrs/week

Credits:04

Title: Reliability and Maintenance Engineering (EL-I)
Class Test (Marks): 20
Theory Examination (Duration): 03hrs
Theory Examination (Marks): 80

Objectives	:	• To present the fundamentals of maintenance and reliability engineering. • To provide the students with the fundamental concepts and the necessary knowledge related to systems reliability and systems maintenance function. • To expose with the necessary engineering techniques used for analyzing, planning and controlling maintenance systems.
Unit-I	:	**Introduction:** Reliability, availability and maintainability, Reliability concepts and patterns of failure, reliability Management. **The failure distribution:** Failure data, reliability function, MTTF, failure rate and hazard rate, Bath tub curve, common distributions in failure mechanisms – exponential, Weibull, Normal, log normal. **[08 Hours]**
Unit-II	:	**Reliability of systems:** Series and parallel configuration, Combined series and parallel configuration, redundant systems. Reliability prediction based on exponential distribution, system reliability analysis – block diagram method, fault tree and success tree methods, event tree method, failure model, failure mechanism. **Reliability design:** Design for reliability, design process, assessment methodology, reliability allocation, reliability improvement, selection of components to improve system reliability. **[12 Hours]**
Unit-III	:	**Reliability, availability & maintainability (RAM) Analysis:** Introduction to RAM failure mechanism, failure data analysis, reliability of repairable and non repairable systems, system reliability by Monte Carlo Simulation Technique. **Reliability Testing:** Product Testing, Reliability Life Testing, Burn –In Testing, Accelerated Life Testing **[10 Hours]**
Unit-IV	:	**Maintenance Engineering:** Fundamentals of Maintenance Engineering, importance of Maintenance, Types of maintenance strategies, planned and unplanned maintenance, breakdown, preventive and predictive maintenance, their comparison, advantages and disadvantages. Introduction to Condition Based Maintenance (CBM), Application and economic benefits, Signature analysis - online and off-line techniques, Various Condition Monitoring (CM) techniques **[08 Hours]**
Unit-V	:	Human factors in maintenance and training, maintenance costing, Maintenance performance. Repair decisions- Repair, replacement and overhaul, Computer applications in maintenance, Expert systems applications, maintenance effectiveness, MIS for maintenance. **[06 Hours]**
Unit-VI	:	**Maintenance in context:** Maintenance and profitability, Life cycle costs, terro-technology, application of terro-technology. **Principles:** the structure of plant, reason for nature of maintenance work, the production maintenance system a dynamic model.

		Failure mode effect analysis, Failure mode effect & critically analysis. **Replacement Decisions:** Economic models, block replacement policy, age replacement policy, replacement policies to minimize downtime, economics of preventive maintenance. **[16 Hours]**
Reference Books:	:	1. An Introduction to Reliability and Maintainability Engineering by Charles E. Ebeling, TMH Publication, New Delhi. 2. Concepts in Reliability in Engineering by L. S. Srinath, Affiliated East West Press. 3. Terotechnology: Reliability Engineering & Maintenance Management by S. K. Basu and B. Bhadury - Asian Books Private Limited 4. Maintenance, Replacement and Reliability- Theory and Applications by A.K.S. Jardine and A.H.C. Tsang, CRC Press, Taylor and Francis, New York. 5. Maintainability, Maintenance and Reliability for Engineers by B.S. Dhillon, CRC Press, Taylor and Francis, New York. 6. Reliability in Engineering Design by K. C. Kapur and L. R. Lumbersome, John Willey and sons. 7. Maintenance Planning and Control by Kelly A , Affiliated East-West Press Pvt. Limited. 8. Maintenance engineering handbook by R. Keith Mobley, Lindley R. Higgins, Darrin J. Wikoff.-7th ed., McGraw-Hill
Additional References	:	9. nptel.iitm.ac.in/ 10. ocw.mit.edu/ 11. see.stanford.edu/ 12. Reliability Engineering and System Safety (Elsevier) 13. International Journal of Reliability, Quality and Safety Engineering (World Scientific Publishing Company) 14. International Journal of Performability Engineering (RAMS Consultant) 15. Quality and Reliability Engineering International (Wiley Online Library) 16. Reliability Engineering (Elsevier) 17. Journal of Quality in Maintenance Engineering (Emerald)

Section: A Units I, II and III; **Section:** B Units IV, V and VI

Pattern of Question Paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of T. Y. B. Tech. (MECHANICAL) Semester-VI

Code No.: MED-393
Teaching Scheme:
Theory: 04 Hrs/week

Credits:04

Title: Mechanical Vibrations (EL-I)
Class Test (Marks): 20
Theory Examination (Duration): 03hrs.
Theory Examination (Marks): 80.

Objectives	:	To make the students aware of the different terms used in mechanical vibrations. To make the students capable of analyzing the problems in the subject. To make the students to analyze problems involving multiple degree of freedom.
Unit-I	:	**Undamped free vibration of single degree-of-freedom systems.** Introduction. Causes and effects of vibrations. Different types of vibrations, single degree of freedom systems. To find the differential equation of motion, for a single degree of freedom system, with no damping, by using energy method, d'Alemberts principle and dunkeley's method. To find the natural frequency of undamped systems of different types, involving linear, angular, torsional, transverse and longitudinal vibrations. **[08 Hours]**
Unit-II	:	**Damped free vibrations of single degree-of-freedom systems:** Damping methods such as viscous damping, coulomb damping, structural damping, hysteresis damping. Analysis of single degree-of-freedom systems having viscous damping .Finding differential equation of motion and determining damped natural frequency of vibrations. Determination of damping factor, obtaining equation of motion for systems such as under damped, critically damped and over damped, for given initial conditions, logarithmic decrement. **[08 Hours]**
Unit-III	:	**Forced vibrations:** Single degree-of-freedom systems. Forced vibrations due to constant amplitude harmonic excitation, eccentric mass excitation, support excitation. Frequency response curves. Determining amplitude of vibrations at various frequency ratios (excitation frequency/natural frequency).Phase-lag angle and its significance, resonance, effect of resonance.Workdone by harmonic force on harmonic motion. Energy absorbed by dash-pot per cycle. **[10 Hours]** **Transmissibility and vibration measuring instruments:** Force transmissibility and motion transmissibility. Frequency response curves. Phase lag angle .Vibration isolation .Isolator design for reducing the transmissibility .Vibrometer and accelerometer. Accuracy of these instruments under different situations .Frequency measuring device. Reed's Tachometer. **[04 Hours]**
Unit-IV	:	**Critical speeds of shafts:** Critical speed, natural frequency of transverse vibrations, factors affecting the critical speed. Determining critical speed of a shaft having one rotor or maximum two rotors.

		Shaft as a continuous system where rotor is not mounted on it (only descriptive). **[08 Hours]** **Two degree of freedom systems:** Introduction, principle modes of vibration, Analysis of two-degree-of-freedom systems such as i) spring-mass systems. ii) Stretched string having two masses. iii) Double pendulum. iv) Torsional system (2-rotor system), v) Systems having linear and angular motion. Static and dynamic coupling, analysis of dynamic vibration absorber. Centrifugal pendulum absorber. **[08 Hours]**
Unit-V	:	**Multiple degree freedom systems(Exact analysis):** Introduction. influence coefficients ,Maxwell's reciprocal theorem. Stiffness coefficient .Static and dynamic coupling .Natural frequencies and mode shapes, using Eigen values and eigenvectors .Determination of natural frequencies, mode shapes and node points, torsional vibrations of geared systems. **[08 Hours]**
Unit-VI	:	**Multiple degree freedom systems (Numerical Methods):** Introduction, Rayleigh's method Dunkerley's method, Stodola's method, Rayleigh-Ritz method, matrix iteration method. Holzer's method. **[08 Hours]**
Reference Books:	:	7. Thomas Bevan ,Theory of Machines, Pearson Education India, 1950 8. S. S. Rattan, Theory of Machines, TMH 9. P. L. Ballany, Theory of Machines, Khanna Publishers, Delhi, 1994. 10. V. P. Singh, Theory of Machines, Khanna Publishers 11. R. S. Khurmi, J K Gupta, Theory of Machines, S. Chand & Sons 12. V. P. Singh, Mechanical Vibrations, Khanna Publishers 13. Groover, Mechanical Vibrations, TMH 14. S S Rao, Mechanical Vibrations, Pearson Education Inc., 2004
Additional Reference Books	:	---

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (MECHANICAL) Semester-VI

Code No.: MED-394	**Title: Introduction to Aircraft Industry and Aircraft Systems(EL-I)**
Teaching Scheme:	**Class Test (Marks): 20**
Theory: 04 Hrs/week	**Theory Examination (Duration): 03hrs.**
Credits:04	**Theory Examination (Marks): 80.**

Objectives	:	• To enable the student to get an exposure to the Aerospace Industry and understand the Basics of Aircraft Systems and Aircraft Structures. This course will also impart Industry Practices on • Design of Aircraft Structures and enable the student to understand the applicability of Design aspects in Aircraft Design so that he/she can relate the theoretical knowledge with the design of Aircraft Structures.
Unit-I	:	**AIRCRAFT INDUSTRY OVERVIEW** Evolution and History of Flight, Types Of Aerospace Industry, Key Players in Aerospace Industry, Aerospace Manufacturing, Industry Supply Chain, Prime contractors, Tier 1 Suppliers, Key challenges in Industry Supply Chain, OEM Supply Chain Strategies, Mergers and Acquisitions, Aerospace Industry Trends, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Global and Indian Aircraft Scenario. **[05 Hours]**
Unit-II	:	**INTRODUCTION TO AIRCRAFTS** Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices. **Types of Aircrafts** - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations-Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders, Blended Body Wing Layout, STOL and STOVL Aircraft, Stealth Aircraft. Advantages and disadvantages of these Configurations. **[07 Hours]**
Unit-III	:	**FUNDAMENTALS OF AIRCRAFT SYSTEMS** Types of Aircraft Systems. Mechanical Systems. Electrical and Electronic Systems. Auxiliary systems. Mechanical Systems: Environmental control systems (ECS), Pneumatic systems, Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems, Steering and Brakes Systems Auxiliary Power Unit, Electrical system. Introduction to Avionics. Autopilot and flight management system, navigation systems, communication, information systems, radar system. **[24 Hours]**

Unit-IV	:	**BASIC PRINCIPLES OF FLIGHT** Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects. **[14 Hours]**
Unit-V	:	**BASICS OF FLIGHT MECHANICS** Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects **Stability and Control** - Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves. **[05 Hours]**
Unit-VI	:	**AIRCRAFT PERFORMANCE AND MANEUVERS** Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on a Aero plane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability. **[05 Hours]**
Reference Books:	:	1. John D Anderson Jr, Introduction to Flight, Tata McGraw Hill Education Private Limited, NewDelhi, 5th Edition, 2009. 2. Karunya notes & website links (only for Unit I)
Additional Reference Books	:	1. David A Lombardo, Aircraft Systems, Tata McGraw Hill Education Private Limited, New Delhi, 2nd Edition, 1998. 2. A.C Kermode, Flight without Formulae, Pearson Education, 5th Edition, 2008. 3. Course material of Faculty Enablement Programme on Introduction to Aircraft Industry, conducted by Infosys, Mysore through Campus connect programme from June 21st-30th, 2010.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester-VI

Code No.: MED-355
Teaching Scheme:
Theory: 02 Hrs/week
Credits:03

Title: Computational Techniques
Class Test (Marks): 10
Theory Examination (Duration): 02hrs.
Theory Examination (Marks): 40.

Objectives		• To equip the students with a strong foundation in logic building and fast problem solving skills • To have thorough understanding about the use of different numerical techniques and to apply them in practical engineering applications
Unit-I	:	**Introduction to Numerical Methods:** Advantages of numerical iterative methods over exact or direct methods. Errors in Computation. **[02 Hours]**
Unit-II	:	**Solutions of Non-Linear Equations:** Different methods used for obtaining roots of non-linear or transcendental equations such as Bisection Method, Regula Falsi or False-position Method, Newton Raphson, Secant Method & successive approximation method, Order of convergence for Newton Raphson and secant methods, Comparison of different methods. Numerical based on Engineering applications. **[06 Hours]**
Unit-III	:	**Solutions of Linear Simultaneous Equations:** Solving linear simultaneous equations using Gauss Elimination, Gauss Jordan Method, Matrix inversion, Jacobi's Method, Gauss Seidel iterative method, Comparison of different methods. Numerical based on Engineering applications. Numerical based on Engineering applications. **[06 Hours]**
Unit-IV	:	**Interpolation:** Langrangian and difference table interpolation, Forward and backward difference & their operators, Newton Gregory forward difference and backward difference formulae, Gauss Central difference formula, Errors in polynomial interpolation, Numerical based on Engineering applications. **[06 Hours]**
Unit-V	:	**Regression Analysis:** Least square approximation, Linear, Polynomial, Hyperbolic and Exponential Regression. Numerical based on Engineering applications. **[04 Hours]**
Unit-VI	:	**Numerical Integration:** Newton-Cotes integration formulae such as Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ Rule, Romberg's integration for obtaining precise results. Numerical based on Engineering applications. **[06 Hours]**

Reference Books: :

Title	Author	Publication
Numerical Algorithms	E.V. Krishnamurthy and S.S.Sen	East West press
Computer oriented Numerical Methods	V.Rajaraman	Prentice Hall

		Numerical Computational methods	Dr.S. S.Deo and P.P. Tawade	Technical Publications
		Inventory methods of Numerical Analysis	S.S.Shastry	PHI
		Numerical Methods in Engineering and Science	B.S.Grewal	Khanna Publishers
		Numerical Methods	Balaguruswamy	

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester- VI

Code No.: MED-371	**Title: Laboratory of Design of Machine Elements - II**
Teaching Scheme	**Practical (Marks) : 25**
Practical : 02 Hrs/week	**Teachers assessment (Marks): 25**
Credits :01	

Course Objective		After successful completion of course students shall able to design mechanical brake, gear box, belt drives.
List of Practical not less than ten		**Practical**
	:	**A. Three full imperial sheets on following:**
		Sheet No. I: At least one problem on single plate, multi-plate, centrifugal clutch belt drive, band brake, short and long shoe brake and internal and external shoe brake.
		Sheet No. II: Gear box should be with minimum two pairs of gear and should include design of casing, bearing.
		Sheet No III : Problem on band brake , Belt Drives (Any one)
		B. Assignments on following topics :
		1. Gears & gear trains 2. Bearing 3. Brakes and clutches 4. Belt rope and Chain drive 5. Optimum design & statistical consideration

Assessment of term work shall be done on the basis of following

- Continuous assessment
- Performing the experiment in the laboratory
- Oral examination conducted on syllabus and term work mention as above

Practical Examination: The practical Examination shall consist of via-voce based on syllabus and term work. The assessment will be based on

- Record of term work submitted
- Via-voce on the syllabus

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad **(Faculty of Engineering & Technology)** **Syllabus of T. Y. B. Tech. (Mechanical) Semester- VI**	
Code No.: MED-372	**Title: Fluid Mechanics &Machineries**
Teaching Scheme:	**Practical (Marks) : 25**
Practical : 02 Hrs/week	**Teachers assessment (Marks): 25**
Credits :01	
Term work shall Consists of record book on laboratory experiments studies on the following	
List of Practical's	**Practical**
	1. Assignment on Chapter 2 2. Assignment on Chapter 3 3. To find the coefficient of discharge by using orifice. 4. To find force exerted by liquid jet on horizontal plate. 5. Trial on Pelton wheel turbine test rig. 6. Trial on Francis Turbine test rig. 7. Trial on Kaplan Turbine test rig. 8. Trial on centrifugal pump test rig. 9. Trial on gear pump test rig. 10. Visit to hydroelectric power plant.

The assessment of term work shall be on the following criteria:

- Continuous Assessment
- Performing the experiments in the laboratory
- Oral examination conducted (internally) on the syllabus and the term work mentioned above

Practical Examination: The practical Examination shall consist of via-voce based on syllabus and term work. The assessment will be based on

- Record of term work submitted
- Via-voce on the syllabus

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (MECHANICAL) Semester VI

Code No: MED-373 **Title: Engineering Metallurgy**
Teaching Scheme: 02 Hrs/week **Teachers Assessment:**
Practical : 25 marks **Credits: 01**
Term Work:25 marks

Course Objectives	:	• To understand the principal of optical microscopy • To prepare specimen for metallography • To study microstructures of steels and non ferrous materials • To study heat treatment and change in the properties of metals • To find properties like hardness, hardenability, wear of metals
List of Practical (Not Less than 10)	:	**Metallurgy** **Experiment** 1. Measurement of Hardness by Rockwell Hardness Test. 2. Study of Metallurgical Microscope. 3. Study of preparation of the specimen for microscopic examination. 4. Observation of the microstructure of various types of Plain carbon steels. 5. Observation of the microstructure of various types of cast irons. 6. Observation of the microstructure of the Non-ferrous alloys. 7. Study of changes in material properties and microstructures of various steel specimens after Heat treatments like Annealing, Normalizing and Hardening. 8. Study of Jominey end quench test to study the concept of Hardenability. 9. Study of properties after age hardening of Aluminum Alloys. 10. Study of change in wear resistance and other related properties of ferrous and non ferrous materials after heat treatment of steels.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Mechanical) Semester- VI

Code No.: MED- 374 **Title: Computational Techniques**
Teaching Scheme:
Practical: 02 Hrs/week
Credits :01 **Teachers assessment (Marks): 50**

Term work shall Consists of record book on laboratory experiments studies on the following

List of Practical	Practical
	1. To Prepare a Program on bisection method using C or C++ language
	2. To Prepare a Program on Newton Raphson method using C or C++ language
	3. To Prepare a Program on Gauss elimination method using C or C++ language
	4. To Prepare a Program on Gauss jordan method using C or C++ language
	5. To Prepare a Program on Lagrange's method using C or C++ language
	6. To Prepare a Program on Newton's forward interpolation method using C or C++ language
	7. To Prepare a Program on Least square approximation method using C or C++ language
	8. To Prepare a Program on Newton's backward interpolation method using C or C++ language
	9. To Prepare a Program on Trapezoidal method using C or C++ language
	10. To Prepare a Program on Simpson's method using C or C++ language

C: Term Work:

The assessment of term work shall be on the following criteria:

- Continuous Assessment
- Performing the Programs in the Laboratory
- Oral examination conducted (internally) on the syllabus and the term work mentioned above

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y.B. Tech. (Mechanical) Semester-VI

Code No:MED-375 **Title: (Project –I)**

Teaching Scheme: 2 Hrs/week **Teachers Assessment : 50 Marks**
Credits: 1

Course Objectives	:	• The practical implementation of theoretical knowledge gained during the study to till date is important for Engineering Education the students should be able to; (i)Implement their ideas/real time industrial problems; (ii) Make current application of their engineering knowledge which they have studied in the curriculum. • The objective of project-I is to ensure that students have adequately demonstrated their preparedness to perform their duties as qualified professional engineers after graduation. • It provides students with challenging opportunities to independently pursue and complete projects based on research and industry practice under appropriate supervision from academic staff members. • To have common platform where interaction between various groups of students will take place on the various advanced and emerging topics of technology. • To realize importance of basic technological aspects.

Guidelines for students and faculty:

A) The project work could be under taken by an indusial student or a group of students not more than four.

1. Project topics may be chosen by the students with advice from the guide/Industry persons (for Sponsored projects), which shall be finalized by guide and approved by concerned head of the department. Students are to be exposed to the following aspects of the project-I presentation
   a) Literature Survey / Review
   b) Organization of the material
   c) System development

To design a project at adequate scale level for the following applications- It may be based Experimental verification, or Design, fabrication, testing and calibration of Mechanical Systems. The software based project can be considered based on its application for Mechanical Engineering.

The students are required to submit the report based on project –I work done in spiral binding.

2. Each students group is required to submit one page proposal for the Project work which shall be received by Department Project Review Committee (DPRC) within one week, after receipt of all proposals at the Appropriate date dewed by the department project coordinator.
3. Project –I shall be essentially a part of weekly academic load.
4. Final evaluation a shall include a presentation on the project work by the students using a suitable Multi-media aid. Maximum time -20 minutes.
5. For award of Sessional marks:
   a) 25 marks - based on the assessment done by internal guide during semester and the involvement of student in the work assigned related to the project topic.
   b) Remaining 25 marks based on the examination at final presentation by at least two examiners, one of them shall be guide and other as an external examiner appointed by the principal of the institute.
6. The project work must be continued in the final year (part -I) under the title Project-II.

Project-I Report Format

The project Report shall be typed on A-4 size white bond paper.

Typing shall be with spacing of 1.5 using one side of the paper.

Margins:-

- Left 37.5 mm
- Right, top and bottom 25 mm.

Binding: -

- Hard with golden embossing on the front cover of brown colour

Front cover of hard bound report:-

It should be identical to first title page.

Default font size TNR-12

10) Format for title page (First Page) (Centre justified)

Report of Project-I (TNR-14, Bold)

in

{Title}(TNR-18, Bold)

by

{Name of student}(TNR-16, Bold)

(Roll No:)

Submitted in partial fulfillment of the requirement for

Degree of Bachelor of Technology (Mechanical Engineering) (TNR-14, Bold)

of

Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad. (TNR-14, Bold)

Department of Mechanical Engineering, (TNR-14, Bold)

Maharashtra Institute of Technology, (TNR-16, Bold)

Aurangabad. (TNR-14, Bold)

201 - 200

11) Format for Certification page (Second page)

CERTIFICATE (TNR-16, Bold)

This is to certify that the Project-I Report

Submitted by

(Name of Student) (TNR-14, Bold)

(Roll No: __)

Is completed as per the requirement of the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad in partial fulfillment of

Degree of Bachelor of Technology (Mechanical Engineering) (TNR-14, Bold)

For the academic Year 20__ - 20__

(Name)	(Name)	(Name)
Guide	Head of Department	Principal (TNR -12, Bold)

12) The third page will be certificate issued by the industry regarding the completion of Project-I if applicable.

13) The fourth page would be for acknowledgement, which would be followed by index page (Fifth page).

14) Sketches should be drawn on separate sheet (minimum A4 size) and be inserted at proper places. The sketches should be drawn in black ink and be numbered.

15) Tables should preferably type in the text only.

16) The mathematical symbol should be typed or neatly written so as to match darkness of the text.

17) The last item on the index should be references.

18) Page number must appear on the right hand top corner of each page starting after index page.

12. The contents of the seminar can be decided by the internal guide / department and student.

13. Minimum number of copies = 5 Copies (Central Library + Department + Internal Guide + External Examiner + Student). The copy of External Examiner will be submitted by the student after completion of Seminar.

Report of Project-I

in

Effect of cooling performance of Automobile Radiator with Nanofluid

by

Mr. Prasad V Muley

(Roll No:)

Submitted in partial fulfillment of the requirement for

Degree of Bachelor of Technology (Mechanical Engineering),

of

Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad.

Department of Mechanical Engineering,

Maharashtra Institute of Technology,

Aurangabad.

200 - 200

SAMPLE COPY

CERTIFICATE

This is to certify that the Project-I Report

Submitted by

Mr. Prasad V Muley

(Roll No:)

Is completed as per the requirement of the Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad in partial fulfillment of

Degree of Bachelor of Technology

(Mechanical Engineering)

For the academic Year 200 – 200

(Name)	(Name)	(Name)
Guide	**Head of Department**	**Principal**

General Attributes

- Chapter heading -All Capital—TNR 14 Font (Bold)
- Heading –All Capital- TNR 12 Font (Bold)
- Subheading–Title case- TNR12 Font (Bold)
- Text – TNR11 Font
- Title of the Report should not be more than two lines
- Page numbers are at right hand corner at ½ inch from right and top side.
- Page number should be allotted only from Chapter no. 1 onwards.

References

Last chapter of the report is references including the addresses of websites.