Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science and Technology

Credit System structure of T.Y. B. Tech. Mechanical Engineering W.E.F. 2022-2023 [Semester V]

Semester V: Theory Courses

Course code	*Name of Theory Course*	Hrs./week				Credits	Examination Scheme			
		L	T	P	D		ISE	ESE	ICA	Total
ME 311	Design of Machine Elements	3	-	-	-	3	30	70	-	100
ME 312	CAD-CAM-CAE	3	-	-	-	3	30	70	-	100
ME 313	Metallurgy	3	-	-	-	3	30	70	-	100
ME 314	Industrial Engineering	3	-	-	-	3	30	70	-	100
ME 315 P	Professional Elective -III	3	-	-	-	3	30	70	-	100
ME 316	Advanced Programming Concepts – I(Python)	1	-	-	-	1				
SLH31	Self Learning -HSS	-	-	-	-	#2	-	50	-	50
	Sub Total	16	-	-	-	16	150	400	-	550

Semester V: Laboratory / Tutorial Courses

Course code	*Name of Laboratory /Tutorial Course*	*Hrs./week*				*Credits*	*Examination Scheme*				
		L	*T*	*P*	D		*ISE*	*ESE*		*ICA*	*Total*
								POE	*OE*		
ME 311	Design of Machine Elements	-	-	2	-	1	-	-	-	25	25
ME 312	CAD CAM CAE	-	-	2	-	1	-	-	-	25	25
ME 313	Metallurgy	-	-	2	-	1	-	-	25	25	50
ME 315 P	Professional Elective -III	-	-	2	-	1	-	-	-	25	25
ME 316	Advanced Programming Concepts - I(Python)	-	-	2	-	1	-	-	-	25	25
Me 317	Workshop Practice - II	-	-	2	-	1	-	-	-	50	50
ME 318	Metrology	-	-	2	-	1	-	25	-	25	50
	Sub Total	-	-	14	-	07	-	50		200	250
	Grand Total	**16**	-	14	-	23	150	450		200	800

Note:# Indicates credits over and above

Abbreviations: *L- Lectures, P –Practical, T- Tutorial, D- Drawing, ISE- In Semester Examination, ESE - End Semester Examination (University Examination for Theory & / POE & / Oral), ICA- Internal Continuous Assessment.*

Professional Elective –III: A. Gas Turbines, B. Tool Engineering, C. Industrial Hydraulics Pneumatics D. Mechanical Vibrations

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science and Technology

Credit System structure of T.Y. B. Tech. Mechanical Engineering W.E.F. 2022-2023 [Semester VI]

Semester VI : Theory Courses

Course code	*Name of Theory Course*	Hrs./week				Credits	Examination Scheme			
		L	T	P	D		ISE	ESE	ICA	Total
ME 321	Transmission System Design	3	-	-	-	3	30	70	-	100
ME 322	Instrumentation and Control Engineering	3	-	-	-	3	30	70	-	100
ME 323	Heat Transfer	3	-	-	-	3	30	70	-	100
ME 324	Industrial & Quality Management	3	-	-	-	3	30	70	-	100
ME 325 P	Professional Elective - IV	3	-	-	-	3	30	70	-	100
ME 327	Advanced Programming Concepts – II(Java)	1	-	-	-	1	-	-	-	-
	Sub Total	**16**	**-**	**-**	**-**	**16**	**150**	**350**	**-**	**500**

Semester VI : Laboratory / Tutorial Courses

Course code	*Name of Laboratory / Tutorial Course*	*Hrs./week*				*Credits*	*Examination Scheme*				
		L	*T*	*P*	D		*ISE*	*ESE*		*ICA*	*Total*
								POE	*OE*		
ME 321	Transmission System Design	-	-	2	-	1	-	-	25	25	50
ME 322	Instrumentation and Control Engineering	-	-	2	-	1	-	-	-	25	25
ME 323	Heat Transfer	-	-	2	-	1	-	25	-	25	50
ME 324	Industrial & Quality Management	-	1	-	-	1	-	-	-	25	25
ME 325 P	Professional Elective - IV	-	-	2	-	1	-	-	-	25	25
ME 326	Workshop Practice - III	-	-	2	-	1	-	-	-	50	50
ME 327	Advanced Programming Concepts – II (Java)	-	-	2	-	1	-	-	-	25	25
ME 328	Mini Project	-	1	-	-	1	-	-	-	50	50
	Sub Total		02	12	-	08	-	50		250	300
	Grand Total	**16**	02	12	-	24	150	400		250	800

Abbreviations: *L- Lectures, P –Practical, T- Tutorial, D- Drawing, ISE- in Semester Examination, ESE - End Semester Examination (University Examination for Theory & / POE & / Oral), ICA- Internal Continuous Assessment.*

Professional Elective – IV: A. Project Management, B. Industrial Product Design C. Plastic Engineering, D. Railway Transportation System.

- **Note** –

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining students exceeds 07, then a new batch shall be formed.
2. Industrial Training (evaluated at Final Year Sem.-I) of minimum 30 days shall be completed in any vacation after S.Y. Sem.-IV but before Final Year Sem.VII & the report shall be submitted and evaluated in Final Year Sem.-VII.
3. Students shall select one Self Learning Module at T.Y. Sem. V from Humanities and Social Sciences.
4. Curriculum for Humanities and Social Sciences Self Learning Modules is common for all under graduate programmes of faculty of Engineering and Technology.

5. **For T. Y. Sem. V**

A. Student can select a Self Learning Course from PAH Solapur University, Solapur HSS Course List and appear for its examination as and when conducted by PAH Solapur University, Solapur

OR

B. Student can enroll for National Programme on Technology Enhanced Learning (NPTEL) course, complete its assignments and Appear for certificate examination as and when conducted by NPTEL.

For more details about Self Learning Course (HSS), please refer to separate rule document available from PAH Solapur University, Solapur (http://sus.ac.in/uploads/engineering/Eng%20Revised%20Semester%20Pattern/Self%20Learning-%20H.S.S.%20courses%20All%20Engg.Branches_2014-15.pdf). More details about NPTEL are available at http://nptel.ac.in

6. ICA assessment shall be a continuous process based on student's attendance and performance in class tests, assignments, homework, seminars, quizzes, case studies and journals, as applicable.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-V

ME 311: Design of Machine Elements

Teaching Scheme
Lectures: 03 Hours/week, 03 Credits
Practical: 02 Hours/week, 01 Credit

Examination Scheme
ESE: 70 Marks
ISE: 30 Marks
ICA: 25 Marks

Course Introduction:
This course seeks to introduce machine design and discusses various procedures, requirements, design methods. It introduces engineering materials and describes the different kinds of irons, steels and alloys used in engineering design with IS Codes. A further content explains in detail the manufacturing considerations in design. Components design procedures for design against static load and fluctuating load is also covered in content of the course. The features and varieties of threaded joints, and welded joints are explained with design considerations. Similarly design of shafts and keys with IS codes, design of couplings; springs and selection of belt drives from manufacturers catalogue is covered in content of the course.

Course Prerequisite:
Student shall have knowledge of function of machine elements such as keys, couplings, pulleys, levers, joints etc. A sound background of analysis of mechanical elements is essential for successful completion of this course.

Course Objectives:
The course aims to :

1. To design machine elements such as springs, shafts, joints, levers, etc.
2. To design mechanical component subjected to fluctuating loads.
3. To implement standardization in design of machine elements.
4. To develop proper approach and logics while designing of different mechanical parts / components.

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

1. Design the machine elements subjected to axial loads
2. Design mechanical component subjected to fluctuating loads.
3. Implement standardization in design of machine elements.
4. Design the machine elements subjected to twisting and bending moments.
5. Develop practical and theoretical approaches to different mechanical component designs.
6. Analyse and design mechanical components on the basis of different design aspects.

Section I

Unit-1: Fundamentals of machine design and Design against static load **No. of lectures-09**

Procedure of machine design, Procedure of design of machine element, Types of loads, Factor of safety- its selection and significance, Theories of elastic failure and their applications, selection of preferred sizes, (No Numerical treatment) Socket and Spigot Cotter joint, knuckle joint, levers (lever loaded safety valve and right-angled bell crank lever) (Numerical treatment).

Unit-2: Design against fluctuating loads **No. of lectures-06**

Stress concentration causes and remedies, fatigue failure, endurance limit, notch sensitivity, Goodman and Soderberg diagram, Modified Goodman diagram, design for finite and infinite life under reversed and fluctuating stresses. (Numerical Treatment).

Unit-3: Selection of Belt **No. of lectures-05**

Selection of flat and V belt from standard manufacturers' catalogue / Design data book. (Numerical Treatment).

Section II

Unit-4: Manufacturing considerations in Design and Design of shafts, keys and couplings **No. of lectures-09**

Design considerations for casting, Design considerations for forging, Design considerations for machined parts, Design for manufacture and assembly.

Materials for shaft, Design of solid and hollow shaft on strength basis (maximum principal stress theory and Maximum shear stress theory) and on basis of torsional rigidity, ASME code for shaft design. Splined shaft (Introductory treatment).

Design of square and flat keys.

Types of couplings- Muff, Rigid flange. (Numerical treatment excluding Splined shaft).

Unit-5: Design of springs **No. of lectures-05**

Types of springs and their applications, terminology of helical spring, styles of end, spring materials, stress and deflection in helical spring, series and parallel springs, introduction to leaf spring. (Numerical treatment excluding leaf spring).

Unit-6: Design of Joints **No. of lectures-06**

Bolted joint- Simple analysis, eccentrically loaded bolted joints in shear, eccentric load parallel to axis of bolt, eccentric load perpendicular to axis of bolt (Numerical limited to static loading).

Welded Joints- Strength of butt welds, transverse fillet welds, axially loaded unsymmetrical lap joint, eccentrically loaded welded joint in shear (Numerical treatment).

Internal Continuous Assessment (ICA): Following eight assignments to be completed :

Part A: Assignment based on the following.

1. Selection of materials for engineering applications as per IS codes, composition and properties.
2. Selection of belts.
3. Design of helical springs subjected to static load.
4. Design of bolted and welded joints.
5. Design of shaft using ASME codes.
6. Manufacturing Considerations in Design.

Part B

7. Design and drawing of Turn buckle.
8. Design and drawing of rocker arm.

Note- Students are required to draw assembly and details of above Mechanical Components on drawing sheet (Sr. No. 7&8) (Suitable software may also be used)

Text Books:

1. "Design of Machine Elements", V.B. Bhandari, 4th edition, McGraw Hill.
2. "Machine Design Data Book", V.B. Bhandari, 2nd edition.

Reference Books

1. Design of Machine Element by J.F. Shigley, McGraw Hill Publications.
2. Design of Machine Element by M.F. Spotts, Pearson Education Publication.
3. Design Data: Data Book of Engineers by PSG College - Kalaikathir Achchagam - Coimbatore.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-V

ME 312 : CAD-CAM-CAE

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

Now-a-days industries cannot survive worldwide competition unless they introduce new products with better quality, at lower cost, and with shorter lead time. Accordingly, they have tried to use the computer's huge memory capacity, fast processing speed, and user-friendly interactive graphics capabilities to automate and bind together thus reducing the time and cost of product development and production. Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), and computer-aided engineering (CAE) are the technologies used for this purpose during the development of mechanical product with best quality and lowest cost. Students must have knowledge of CAD, CAM and CAE. Therefore, this course contains syllabus related to CAD, CAM and CAE activities.

Course Objectives:

The course aims to :

1. Create an awareness regarding Geometric Modeling activities in Industries.
2. Create an awareness regarding CAM activities in Manufacturing Industries.
3. Develop part programming capabilities for CNC machines.
4. Empower students to learn advanced tools in Automation.
5. Utilize modern tools for design, analysis and manufacturing activities.

Course Outcomes:

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

1. Solve CAD related problems from industries.
2. Elaborate the concept of geometric modelling
3. Create solid model in CAD/CAM/CAE environment according to predefined parameters
4. Analyze Geometric transformations and FEA applications to mechanical component.
5. Solve CAM related problems of manufacturing industries.
6. Develop CNC part programming to operate CNC milling & turning machine to manufacture a Mechanical part.

Section I

Unit-1: Introduction to CAD / CAM/CAE **No. of lectures- 04**

Product Cycle and CAD / CAM/CAE, Advantages of CAD / CAM/CAE, Hardware used for CAD/CAM/CAE system, List of input/output devices, Functions of Graphics Software, `Selection of CAD / CAM/ CAE Software.

Unit-2: Computer Graphics and Geometric Modeling **No. of lectures- 08**

Geometric Transformations, Homogeneous Coordinates, Windowing and Viewing Transformations, Coordinate Transformations, Standardization in Graphics Software, CAD / CAM Data Exchange. Introduction to Geometric Modeling and its types, Parametric representation of basic entities like line and circle, Introduction to basic curves - Bezier, B-Spline, NURBS, concept of CSG and Boolean operations, Feature based modeling.

Unit-3: Finite element method and Automation **No. of lectures- 08**

Finite element method: Definition, Types of analysis, terms used in FEM, types of nodes and elements, General Steps of the FEM, Structural and thermal analysis of 1-D bar elements, Introduction to latest FEA software.

Automation: Concept & Definition of Automation, Types, Advantages and Limitations of Automation, Automation and CAD/CAM, CIM and CAD / CAM, Group Technology, part family, Classification and Codification System, Merits and Demerits of Group Technology, CAPP, Retrieval and Generative type of CAPP, MRP, concept of ERP, concept of Rapid Prototyping.

Section II

Unit-4: Fundamentals of NC system **No. of lectures- 06**

Evolution of NC and Retrofitting, Elements of NC Manufacturing System, concept of work zero and machine zero, Types of NC systems, Structure, Drives and other devices, Steps in NC Manufacturing, Advantages and Disadvantages of NC Technology, Flexible Manufacturing System (FMS), Elements of FMS, Applications of FMS, Merits and Demerits in FMS.

Unit-5: CNC- DNC Technology and Tooling **No. of lectures- 06**

Classification of CNC machine tools, CNC controllers, Features and Advantages of CNC, Adaptive Control, Advantages of Adaptive Control, Direct Numerical Control, Types of Direct Numerical Control, Advantages and Disadvantages of Direct Numerical Control, Tool holders, Adapters, Tool magazines, Automatic tool changers, Pallets, Tool setting, Modular tooling.

Unit-6: Manual Part Programming **No. of lectures- 08**

Principles of an NC Program, Word Address Format (WAF), Machining Formulas, Tool Length and Cutter Diameter Compensation, Canned Cycles for Lathe, Milling and Drilling, Introductory treatment of Subprogram, Subroutines, DO Loop, Macros.

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Assignment on Modeling & Drafting of any two mechanical components.
2. Assignment on Modeling of simple Assembly of around 3-5 machine components.
3. Assignment on Elements used in FEM analysis
4. Assignment on Rapid Prototyping
5. Assignment on FEA based structural analysis of simple mechanical component.
6. Assignment on FEA based thermal analysis of simple mechanical component.
7. Part programming of one job using CAM software or Programming and manufacturing of one job on CNC lathe or CNC Milling machine.
8. Assignment based on Industrial visit and its report based on CNC/FMS/Automation.

Text Books:

1. Introduction to CAD/CAM, Rao P.N., -Tata McGraw Hill Publishing Co.
2. Automation, Production Systems and Computer Integrated Manufacturing, Grover M.P.- Prentice Hall of India
3. Numerical Control -Computer Aided Manufacturing, Kundra, Rao, Tiwari- TMHillPub.Co.
4. CAD/CAM/CAE, Chougule N.K.- SCITECH Publications (I) Pvt. Ltd.
5. CAD/CAM/CIM, P. Radhakrishanan.

Reference Books

1. Introduction to CAD/CAM, Rao P.N., -Tata McGraw Hill Publishing Co.
2. Automation, Production Systems and Computer Integrated Manufacturing, Grover M.P.- Prentice Hall of India
3. Numerical Control -Computer Aided Manufacturing, Kundra, Rao, Tiwari- TM Hill Pub. Co.
4. CAD/CAM/CAE, Chougule N.K.- SCITECH Publications (I) Pvt. Ltd.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-V

ME 313 : Metallurgy

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02 Hours/week, 01 Credit	**OE : 25 Marks**
	ISE : 30 Marks
	ICA : 25 Marks

Course Introduction: Metallurgy is an art of extracting the pure metals from its ore. Its full scope is in:

a) Mixing two or more metals to form an Alloy.

b) Shaping the metals & alloys by different processes such as Casting, Forming, and Joining etc.

c) Undergoing suitable Heat treatment for modifying the properties.

d) And finally, in Inspecting & testing before putting the products in to use.

Course Objectives:

The course aims to:

1. Identify Structures, composition, properties, applications of materials and their selection for design purpose.
2. Carry out testing of materials and its significance
3. Acquire knowledge of heat treatment processes for different engineering materials.
4. Acquire knowledge of powder metallurgy process and composite materials with its applications

Course Outcomes:

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

1. Select ferrous alloys for engineering applications.
2. Demonstrate the significance of heat treatment processes for engineering applications.
3. Apply powder metallurgy for manufacturing of products.
4. Establish the characteristics of non-ferrous alloys.
5. Select suitable non-destructive testing method for products.
6. Establish the characteristics of composite materials.

Section I

Unit-1: Introduction to ferrous alloys **No. of lectures-06**

Brief classification of Metals, Concept of alloying, Classification of cooling curves, Types of equilibrium diagram, Lever rule, phase rule, Solid solution & its types, Intermetallic compounds, allotropy

Unit-2: Ferrous metals and alloys **No. of lectures-10**

Fe-Fe3C equilibrium diagram, critical temperatures, Plain carbon steels: composition, applications & properties, Effect of alloying elements on steels, Eutectic, Eutectoid and Peritectic transformations, Plain carbon steels, classification, composition, properties &applications, Types of cast irons, composition, properties, applications. Alloy steels, alloying elements added to steels and their purpose.
Study of composition, properties and applications of following alloying steels.
1. HSLA steels 2. Spring steels 3. Silicon steels
4. Hadfield 'Mn' steels 5. HCHC steels 6. Water hardening steels
7. Oil hardening steel 8. Air hardening steel 9. Hot working tool and Die steel 10. Chisel steels
11. HSS 12. ONHS 13. Stainless steels and its types 14. Invar 15. Steels for subzero applications

Unit-3: Non-ferrous alloys, composites and Nano materials **No. of lectures-04**

Non-ferrous alloys
Copper alloys: brasses, bronzes. Aluminum alloys: Al-Si alloy, Al-Cu alloy.
Steps in precipitation hardening (Steps only), Pb-Sn alloys, Study of Babbits. Introduction to Ni alloys.
Composite materials: Classification, properties and Applications
Nano materials – Concept, effect of particle size on mechanical properties.

Section II

Unit-4: Heat treatments of steel **No. of lectures-10**

Objectives of Heat Treatment, TTT and CCT diagram for eutectoid Steel (Introductory treatment only)
Annealing - purposes, types, applications, limitations.
Normalizing- purposes, types, applications, limitations.
Hardening & Tempering: purposes, types, applications. Types of Tempering, structural changes during tempering, Subzero treatment.
Methods of hardening such as Austempering, Martempering, limitations of these process, Surface hardening treatments.
Carburising – types, Nitradiing. Cyaniding and carbinitriding – Purposes, chemistry of process, applications, limitations.
Induction hardening , Flame hardening – Concept process, advantages, limitations and applications.

Unit-5: Destructive and Non-Destructive testing **No. of lectures-06**

A. Destructive testing methods, test procedure in brief, significance of
i) Tensile testing ii) Hardness testing iii) Impact testing iv) Creep v) Fatigue testing.
B. Study of Non-Destructive Testing methods (NDT) such as
i) dye penetrant test ii) magnetic Particle test iii) Ultrasonic test iv) Radiography test v) Eddy current test. Introduction to advanced NDT methods.

Unit-6: Introduction to powder metallurgy **No. of lectures-04**

Significance, steps in powder metallurgy process, Applications, Methods of powder manufacture, mixing / blending, compaction methods, sintering processes & types, advantages & limitations, Typical powder metallurgy applications and their flow chart: - Self lubricated bearings, cemented carbide cutting tools, friction materials, etc

Internal Continuous Assessment (ICA): Any eight experiments out of the following)

1. Study of metallurgical microscope
2. Study of specimen preparation for microstructure observations
3. Study of microstructures of P.C. steels
4. Study of microstructures of white, grey, S.G. iron, Malleable iron
5. Study of microstructures of Bronzes, brasses
6. Demonstration of Annealing, Normalizing, Hardening and Tempering
7. Demonstration of Tensile, Impact, and Hardness tests.
8. Demonstration of at least one NDT method
9. Study of microstructures of carburized, nitrided, Induction hardened steels
10. Demonstration of Macro examination such as Spark test

Text Books:

1. Material Science and Metallurgy – Dr. Kodgire (Everest, Pune).
2. Engineering Metallurgy I & II – A. S. Gholap& M. S. Kulkarni
3. Introduction to Engg. Materials – B. K. Agarwal (TMH).

Reference Books

1. Heat treatment principles and technique - Rajan Sharma & Sharma
2. Introduction to Physical metallurgy – Avner, TMH.
3. Engineering Metallurgy Vol. I & II – R. A. Higgins (ELBS).
4. Engineering Metallurgy – E. C. Rollason (ELBS)
5. Engineering Metallurgy - Lakthin (MIR Publishers).

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.TECH. (Mechanical Engineering)

Semester-V

ME 314 : Industrial Engineering

Teaching Scheme
Lectures: 03Hours/week, 03 Credits

Examination Scheme
ESE: 70Marks
ISE: 30Marks

Course Introduction:

Industrial Engineering is concerned with the design, improvement and installation of integrated system of people, material, information, equipment and energy. Its draws upon specialized knowledge and skill in the mathematical, physical and social science together with the principles and methods of engineering analysis and design, to specify, predict and evaluate the results to be obtained from such systems. This course includes, Introduction of basic concepts of IE and its applications to improve productivity for manufacturing and service sector. To understand concept of method study, work measurement, Job evaluation and merit rating for improving overall productivity. To acquire knowledge about plant layout, facility location, safety and ergonomic consideration
for improving productivity.

Course Objectives:

The course aims to:

1. To apply concept of productivity and illustrate different methods to improve it.
2. To acquire about knowledge of charts and apply for method study
3. To understand concepts of ergonomics and industrial safety
4. To establish standard time for work.
5. To select facility location and design plant layout.
6. To acquire knowledge of job evaluation and merit rating

Course Outcomes:

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

1. Analyze & measure productivity.
2. Perform method study
3. Apply knowledge of ergonomics and industrial safety
4. Perform work measurement’
5. Select facility location and design plant layout
6. Apply knowledge of job evaluation and merit rating

Section I

Unit-1 : Introduction to Industrial Engineering **No. of lectures- 06**

Definitions and meaning of I.E., contribution by F.W. Taylor, Gilbreth, objectives of I.E.
Productivity - Factors affecting productivity and ways to improve productivity.
Work Study – Definitions, objectives, Importance of work study procedure, Relation of work study with – work Simplification, Human Relation. (Numerical treatment)

Unit-2: Method Study **No. of lectures-08**

Definition, objective, Scope of method study, Basic procedure symbols and recording of facts, Charting conventions, Charts – Operation process chart, Flow process chart, Multiple activity chart, Two handed process chart, Diagrams – Flow and string diagram, travel chart Templets and models, Micro motion study. Therbligs simo chart, Critical examination and selection, Implementation method

Unit-3: Ergonomics and Industrial Safety **No. of lectures-06**

Definition, Man Machine system, Types of display, types of control, manual material handling, Anthropometry, Design of work place and working conditions, ILO Norms. Definition of accident, Cause of accident, Prevention of accident, safety measures factor acts, minimum wages act, Employers state Insurance act.

Section II

Unit-4: Work Measurements **No. of lectures- 07**

Definition, objective and techniques of work measurement, time study, stop watch method, performance rating, allowance, relaxation interference contingency, policy, calculation of standard time, work sampling its need and procedure, predetermined motion time study(PMTS). (Numerical treatment)

Unit-5: Facility Locations and Plant Layout **No. of lectures-07**

a) Factors affecting site selection:
- Intangible factors for facility location, tangible factor for facility location, advantages and disadvantages of facility location in urban and rural areas.

b) Plant Layout:
- Characterization of an efficient layout objectives of plant layout, principles of plant layout, procedure in planning layout, types of plant, layout product/line layout, process/functional layout, fixed position/static layout, cellular/Group Technology layout, selection of material handling equipment.

Unit-6: Job Evalutions and Merit Rating **No. of lectures-06**

Job evalution: objectives, advantages and procedure, job analysis, job description, job specification, methods of evolution. Merit rating: Objectives and Method of Merit rating.

Text Books:

1. Industrial engineering and Production management by Martand Telsang. (S. Chand)
2. Engineering management by A. K. Gupta (S. Chand)
3. Industrial Engineering and Management by O. P. Khanna.

Reference Books

1. Introduction to work study by ILO. (Universal Publication)
2. Work Study by O. P. Khanna. (Dhanpat Rai and Sons)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-V

Professional Elective - III

ME 315 (A) GAS TURBINES

*Teaching Scheme	*Examination Scheme
Lectures : 03 Hours/week, 03 Credits	ESE : 70 Marks
Practical : 02Hours/week, 01 Credit	ISE : 30 Marks
	ICA : 25 Marks

Course Introduction:

The aim of the course is to provide fundamental knowledge and understanding about the functionality of turbine turbines. This knowledge will enable the students how a turbine can be highly efficient while having the least impact on environment. That is to aim for a green energy to contribute in sustainable development.

Course Objectives:

During this course, student is expected to:

1) Study the classification of gas turbines and its applications
2) Study Analysis of gas turbine cycles
3) Study Basic gas dynamics
4) Study dynamic compressors and their performance parameters.
5) Explain types of combustion chambers in gas turbines

Course Outcomes:

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

1) Classify and distinguish gas turbine cycles.
2) Analyze the gas turbine cycles
3) Discuss gas dynamics terms, construction, working and performance of centrifugal compressors
4) Discuss gas dynamics terms, construction, working and performance of axial compressors
5) Draw T-S diagram, Velocity diagrams and calculate work, efficiency.
6) Select combustion chamber and gas turbine materials.

Section I

Unit-1: Introduction No. of lectures **No. of lectures- 04**

Development of gas turbine, Classification of gas turbines, Comparison of Gas turbine and reciprocating I.C. Engines, Comparison of Gas turbine and steam turbine, Applications of gas turbines

Unit-2: Analysis of gas Turbine Cycles No. of lectures **No. of lectures- 08**

Brayton cycle and its analysis, Effect of maximum temperature on cycle efficiency and work ratio, Optimum pressure ratio for maximum work output, Intermediate temperature for optimum work and equation for maximum work output. Actual gas turbine cycle, effect of parameters on performance of cycle. Methods of improving the thermal efficiency and specific work output of gas turbine cycle, Gas turbine cycle with regeneration, intercoolingreheating. Gas turbine cycle with water injection. (Numerical treatment)

Unit-3: Basic gas Dynamics No. of lectures **No. of lectures- 08**

Introduction , Propagation of small disturbance-the velocity of sound, Mach number, Mach cone and Mach angle, Total or stagnation properties, One-dimensional adiabatic flow, Isentropic flow, Isentropic flow in a passage of variable cross-section area, Flow through a convergent nozzle-effect of pressure ratio, Flow through a convergent-divergent nozzle. (Numerical treatment)

Section II

Unit-4: Centrifugal Compressors No. of lectures **No. of lectures- 08**

Steady flow compressors, Construction and working of centrifugal compressor, Representation of processes in suction pipe, impeller, diffuser and delivery pipe on T-S diagram, Actual and isentropic work done, Analysis of centrifugal compressors-velocity diagrams, Euler work, ideal power, width of impeller blades, vane shapes and their characteristics. Slip factor, power input factor, Pressure coefficient, prewhirl(Numerical treatment)

Unit-5: Axial flow compressors No. of lectures **No. of lectures- 08**

Introduction, Components and working of axial flow compressor, velocity diagrams for axial flow compressors, representation of processes on T-S for single stage compression, degree of reaction, relation between blade angles for 50% degree of reaction, work input factor, polytropic efficiency, Surging and chocking, losses in axial flow compressors, comparison between axial flow and centrifugal compressors (Numerical treatment).

Unit-6: Gas Turbine Combustion Chamber No. of lectures **No. of lectures- 04**

Introduction, requirements, combustion process in gas turbines, types of combustion chamber, gas turbine materials- requirements and selection, fuels for gas turbine, cooling of gas turbine blades

Internal Continuous Assessment (ICA):

Following assignments to be completed

1. Assignment based on introduction of gas turbines
2. Assignment based on analysis of gas turbine cycles

3. Assignment based on actual gas turbine cycles
4. Assignment based on basic gas dynamics
5. Assignment based on flow through nozzles
6. Assignment based on centrifugal compressors
7. Assignment axial flow compressors
8. Assignment based on gas turbine chambers

Text Books:

1. Gas Turbines, V. Ganeshan, Tata McGraw Hill Education
2. Gas Turbines and Jet & Rocket Propulsion, Dr.Mathur&R.P.Sharma, Standard Publishers, New Delhi
3. Applied Thermodynamics-VI,B.L.Singhal, Tech-Max Publications,Pune

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-V

Professional Elective - III

ME 315 (B) : Tool Engineering

Teaching Scheme
Lectures– 03 Hours/week, 03Credits
Practical – 02 Hour/week, 01Credit

Examination Scheme
ESE–70Marks
ISE –30Marks
ICA- 25Marks

Course Introduction:
This course seeks to provide an introduction to tool engineering and discusses various procedures, requirements, tooling methods. It introduces engineering materials and describes the different kinds of tools, jig & fixture used in industries. A further content explains in detail the design of press tool draw tool jig & fixture as well as tool nomenclature and geometry.

Course Objectives: During this course, students are expected:
1. To enlighten the students about the basics in mechanics of cutting & non cutting operations.
2. To explain the students about the basics in economics of cutting & non cutting operations.
3. To explain the concepts, principles & practices in designing jig and Fixture.
4. To elaborate the concepts, principles & practices in designing .

Course Outcomes: At the end of this course, students will be able to:
1. Students are able to do the calculations involved in the mechanics of machine
2. Students are able to design & draw the tools & tooling for the given situation & operation
3. Students are able to conceive & develop solutions for cutting and non cutting operations.
4. Students are able to conceive contrivances to overcome present problems of the real world.
5. Students are able to select appropriate material.
6. Students are able to prepare & develop sequence of operation for particular component.

Section-I

Unit 1– Basics of Tool Engineering **No of lectures – 08**

a) Single point cutting tools- Geometry & Tool signature as per ASA system & ORS system, effect of geometry on tool life, cutting force, surface finish.
b) Types of metal cutting process –orthogonal and oblique cutting, Force analysis for orthogonal cutting, types of chips, chip thickness ratio, shear angle, Tool dynamometers and Merchant circle.
c) Geometry and nomenclature of multi point cutting tool like a drill, milling cutter, broaches, and reamers.
d) Cutting tool materials - types, composition, properties and applications

Unit 2– Machinability & Tool Life **No of lectures –04**

a) Machinability Index, factors affecting Machinability.
b) Tool life- Flank & crater wear, effect of variables on tool life, Taylor's equation of tool life
c) Coolants- Heat generation, types of coolants.

Unit 3– Press Tools **No of lectures –08**

a) Elements of press tools, types of dies, types of operations.
b) Design of die for cutting operation, mechanics of shearing, cutting force estimation, punch & die clearance, stock strip lay out, design of punches & die block functioning & place of other elements.
c) Centre of pressure, selection of die set & press
d) Design of drawing dies determination of blank size, no. of draws, stage wise component drawing, drawing radii, clearance, and estimation of drawing force.
e) Types of Bending die, related estimates.

Section-II

Unit 4–Locating & Clamping Devices for jig and fixture. **No of lectures – 08**

a) Definition concept of locating and clamping.
b) Types of locating and clamping devices.
c) Types of redundant locations.
d) Fool proofing and indexing techniques.

Unit 5–Design of Jigs & Fixtures **No of lectures – 08**

a) Design of Jigs- Principles of Jig design, types &applications, types of bushes &selection, use of standard parts, design procedure & drawing.
b) Design of Fixtures- Principles of Fixture design, standard elements & types of fixtures, design of milling fixtures.

Unit 6– Economics of Tooling **No of lectures – 04**

a) Elements of cost: methods of depreciation
b) Estimation of total cost & sales price
c) Break- even analysis for equipment selection
d) Economics of small tool selection, equipment replacement
e) Economic Order Quantity for Batch production

Internal Continuous Assessment (ICA) :

Following eight assignments / exercises/experiments:

1. Exercise on theory of metal cutting.

2. Design and drawing of press tool for particular component.
3. Design and drawing of draw tool for particular component.
4. Design and drawing of a jig for given component.
5. Design and drawing of milling fixture for particular component.
6. Demonstration of lathe tool dynamometer
7. Drawing sheet on geometry and nomenclature of multi point cutting tool like a drill, milling cutter, broaches, reamers.
8. Software modeling - Jig design- Exercise & modeling

*__Note:__ Any engineering software package suitable for modeling may be used.

Text Books:

1. Text Book of Production Engineering – P.C.Sharma (S.Chand Publication)
2. Machine Tool Engineering – G.R. Nagpal (khanna Publication)
3. Press Tools – P.H.Joshi (S.Chand Publication)
4. Jigs & Fixtures - P.H.Joshi (S.Chand Publication)

Reference Books:

1. Metal cutting Theory & tool design- Mr. Arshinnov (MIR Publication)
2. Fundamentals of Tool design- ASTME Publication
3. Tool design – Donaldson (TMH Publication)
4. Jig & Fixture Design – Kempster (ELBS Publication)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-V

Professional Elective - III

ME 315 (C) : Industrial Hydraulics & Pneumatics

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

This course introduces hydraulic system & pneumatic system. Initially it covers the construction & working of various components of fluid power systems. Preparation of hydraulic & pneumatic circuit diagrams for various applications using the ISO symbols of hydraulic & pneumatic components is covered. Inclusion of use of catalogues of hydraulic & pneumatic component manufacturers for selection of components is also done in this course. Students will be made familiar with use of software for hydraulic & pneumatic circuit design.

Course Objectives:

The course aims to:

1. Understand advantages & disadvantages of fluid power systems.
2. Become familiar with the construction and function of the different hydraulic & pneumatic components/ devices.
3. Know suitability of any hydraulic & pneumatic components for specific application.
4. Understand the operation of basic circuits

Course outcomes:

At the end of this course, students will be able to

1. Choose hydraulic & pneumatic systems for proper applications
2. Explain construction & working of hydraulic & pneumatic system components/ devices
3. Select appropriate actuators for a particular application
4. Draw symbols of hydraulic & pneumatic system components/ devices
5. Prepare hydraulic & pneumatic circuits for various applications
6. Identify process flow on a hydraulics or pneumatic schematic

Section I

Unit-1: Introduction to Fluid Power System & Hydraulic Actuators **No. of lectures-06**

Fluid Power System: Introduction, Types, advantages, limitations & applications. Basic components of Hydraulic system, Hydraulic Actuators- Linear & Rotary, Types, Working, Construction, Cushioning effects, Calculation of velocity & force, Seals & Packing- Types, materials, applications

Unit-2: Pumps, Accumulators, Intensifiers & Valves **No. of lectures-08**

Pumps- Classification, construction, operation, advantages, applications, Pump performance, Characteristics. System components: Accumulators, Intensifiers, their types, working, applications,

Hydraulic Pressure control valves- Direct acting type, pilot operated, sequence, counter balancing, unloading, pressure reducing, Construction & Working, Direction control valves- Types, construction & working, Spool actuationmethods, spool centre positions. Flow control valves- Compensated & Non-Compensated, Construction & Working, One way valve. Symbols of above components/ devices

Unit-3: Hydraulic circuits **No. of lectures-06**

Simple circuit, Speed control circuits: Meter in, Meter out & bleed off circuits, Regenerative circuit, Sequencing circuit, Counter balancing, Synchronizing, Circuits with accumulator & intensifier

Section II

Unit-4: Introduction to Pneumatic system & Actuators **No. of lectures-06**

Pneumatic system: Advantages, limitations & applications of pneumatic system, Comparison of hydraulic & pneumatic system, ISO symbols used in pneumatic circuits, pneumatic cylinders and air motors, types, construction and working

Unit-5: Pneumatic System Elements & Valves **No. of lectures-08**

Air compressors, types, working, selection criteria, FRL unit, construction and working, Direction control valves, Flow control valves and pressure control valves – types and working, Quick Exhaust valve, time delay valve

Unit-6: Pneumatic circuits **No. of lectures-06**

Simple Pneumatic circuits, time delay circuit, Pneumatic clamping system, Pneumatic braking systems, Pneumatic power tools

Internal Continuous Assessment (ICA): Any 8 from given list of experiments

1. ISO symbols for different components of Hydraulic and Pneumatic system
2. Study of hydraulic valves
3. Study of pneumatic valves
4. Demonstration of Hydraulic speed control circuits
5. Demonstration of hydraulic speed control circuits
6. Demonstration of Traverse & feed circuit
7. Demonstration of sequencing circuit
8. Demonstration of pneumatic circuits
9. Test on Gear/Vane/Piston pump and plotting of performance characteristic
10. Software use for hydraulic & pneumatic circuit design
11. Design of hydraulic/pneumatic circuit for practical application, Selection of different components such as reservoir, various valves, actuators, filters, pumps based on design. (Students are advised to refer manufacturers' catalogues)
12. Visit to Service station of Earth Moving equipment (Note: Students should write visit report based on the observations made during the visit)

Text Books:

1. Oil Hydraulics- Principle & Maintenance, S. R. Majumdar, Tata McGraw Hill
2. Hydraulics and Pneumatics H.L.Stewart – Industrial Press
3. Pneumatics- Principle & Maintenance, S. R. Majumdar, Tata McGraw Hill
4. Fluid Power with Applications, Anthony Esposito, Pearson Education

Reference Books

1. Eaton-Vickers Industrial Hydraulics Manual
2. Festo's Manual on Pneumatic Principle, applications
3. Hydraulics And Pneumatics, Jagadeesha T, Dreamtech Press

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.TECH. (Mechanical Engineering)

Semester-V

Professional Elective - III

ME315 (D) : Mechanical Vibrations

Teaching Scheme	**Examination Scheme**
Lectures:03Hours/week, 03 Credits	**ESE: 70Marks**
Practical :02Hours/week, 01Credit	**ISE: 30Marks**
	ICA: 25Marks

Course Introduction:

Vibration is a common phenomenon existing in a mechanical system. Mechanical structures and systems are susceptible to vibrations, i.e. periodic changes in the physical state. Vibrations can both be a hindrance and a benefit to machines. In this course, we will learn how one can predict vibrations and interpret the measured vibrations using analytical and experimental means. The topic covered in the syllabus are damped and undamped free and forced vibration, Analysis of single-DOF, Two-DOF and multi-degree-of-freedom vibratory systems using energy conservation principles, vibration absorber and vibration measuring instruments.

Course Objectives:

The course aims to :

1. Study basic concepts of vibration
2. Develop competency in understanding vibration in systems
3. Develop analytical competency in solving vibration problems
4. Understand the various instrument used vibration measurement and techniques to control the vibrations

Course Outcomes:

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

1. Explain basic concepts of vibration in mechanical systems
2. Estimate natural frequency for single DOF undamped & damped free vibratory systems.
3. Determine response to forced vibrations due to excitation forces and Compute the parameters of vibration isolation system
4. Analyze vibration response of two DOF vibratory system
5. Estimate natural frequencies for multi-DOF vibratory systems
6. Describe the vibration measurement instrument and condition monitoring techniques for industrial / real life applications.

Section I

Unit-1: Fundamentals of Vibration **No. of lectures-05**

Vibration and Oscillation, Causes and effects of vibrations, Parameters of vibration, Damping, Motion-periodic, non-periodic, harmonic, non-harmonic, Degree of freedom, Static equilibrium position, classification of vibration, steps involved in vibration analysis, simple harmonic motion, vector and complex method of representing vibration, fourier series and harmonic analysis.

Unit-2: Free Single Degree of freedom of Vibration system **No. of lectures-08**

Undamped Free Vibration: Vibration system, Derivations for spring-mass systems, Methods of Analysis –D'Alembert's principal, newton, Energy, Lagrangian and Rayleigh method, Natural frequencies of simple systems, springs in series and parallel, Torsional and transverse vibrations, Effect of the mass of spring.

Damped Free Vibration: Types of damping, Analysis with viscous damping – Derivations for over, critical and underdamped systems, Logarithmic decrement and damping materials.

Unit-3: Forced Single Degree of freedom of Vibration system **No. of lectures-07**

Forced Vibration: Introduction, Analysis of forced vibration with constant harmonic excitation – magnification factor, rotating and reciprocating unbalances and excitation of support

Vibration Isolation and Control: Force Transmissibility, motion transmissibility, typical isolators & mounts. Introduction to Semi-Active and Active Vibration control, Energy dissipated due to damping.

Section II

Unit-4:Systems with two Degree of freedom **No. of lectures-08**

Principal mode and natural frequencies of vibration, normal mode and natural frequency of systems-Spring mass system, double pendulum, torsional system, geared system, undamped dynamic vibration absorber.

Unit-5:Multi-Degree of Freedom Vibration system **No. of lectures-06**

Introduction, Free vibration of Multi DOF system: flexibility and stiffness influence, Rayleigh's method, Matrix iteration method, Holzer's method.

Unit-6: Vibration Measurement and condition monitoring **No. of lectures-06**

Vibration Measuring Instruments: Principal of seismic Instruments, Vibrometers, accelerometer-undamped and damped, Exciter and FFT analyzer.

Condition Monitoring: Introduction to conditioning monitoring and fault diagnosis, Condition & Vibration Monitoring Techniques, vibration data collection. Experimental modal analysis, Signature analysis.

Internal Continuous Assessment (ICA):
List of Experiments/Assignments/Case Studies, etc.
Minimum 8 experiments out of following list:

1. Experiment on equivalent spring mass system
2. Experiment on study of forced vibration characteristics with and without damping
3. Determine logarithmic decrement for single degree of freedom system
4. Experiment on free torsional vibration of single or two rotor system
5. Experiment on vibration isolation system and prediction of force and motion transmissibility of system
6. Assignment on two DOF system for determination of natural frequencies
7. Assignment on Multi DOF system for determination of natural frequencies
8. Introduction to FFT analyzer and prediction of spectral response of vibrating machine
9. At least two case studies in detail based on condition monitoring and fault diagnosis

Text Books:

1. Mechanical Vibrations by S.S. Rao, fourth edition, Pearson Education
2. Mechanical Vibrations by G. K. Grover
3. Fundamentals of Mechanical Vibration by S. Graham Kelly, Tata McGraw Hll
4. Vibration Analysis by P. Srinivasan, Tata McGraw Hill
5. Mechanical Vibrations- Schaum's outline series, William W. Seto, McGraw Hill

Reference Books

1. Elements of Vibration Analysis by Leonard Meirovitch, McGrmv- Hill, New York
2. Mechanical Vibrations by J.P.Den Hartog, McGraw Hill Book Company Inc
3. Mechanical Vibrations by Den, Chambil, Hinckle
4. Theory of Vibration with Applications, by W. Thomson, 2nd edition, Pearson Education

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-V

ME 316 Advanced Programming Concepts – I (Python)

Teaching Scheme
Lectures : 01 Hour/week, 01 Credits
Practical : 02Hours/week, 01 Credit

Examination Scheme
ICA : 25 Marks

Course Introduction:

By the end of this course, students will have gained a fundamental understanding of programming in Python by creating a variety of scripts and applications for the Web and for systems development. Python is a versatile programming language, suitable for projects ranging from small scripts to large systems. The course emphasizes best practices such as version control, unit testing and recommended styles and idioms. Students will explore the large standard library of Python, which supports many common programming tasks.

Course Objectives:

The course aims to :

1. Introduce the core components of python programming language.
2. Introduce procedural and object-oriented style for writing Python scripts.
3. Introduce standard library packages and modules in Python.
4. Study exception and file handling in python

Course Outcomes:

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

1. Describe basic concepts in Python programming
2. Write python script using procedure-oriented approach
3. Use Python standard library modules in writing Python scripts for problem solving
4. Write Python scripts in object-oriented approach.
5. Apply file handling options available in Python in programming
6. Exhibit ability to use python to provide solution to a given problem.

Section I

Unit-1: Introduction to python **No. of lectures-02**

Introducing the Python Interpreter, Program Execution, Execution Model Variations, The Interactive Prompt, System Command Lines and Files.

Unit-2: - Introduction to Python Programming basic concept **No. of lectures-03**

Data types and variables, Collection data types, Control structures, loops and functions, String handling.

Unit-3: Exception Handling **No. of lectures-02**

Definition, types of exception, try block, catch block, finally block, custom exception.

Section II

Unit-4: File Handling **No. of lectures-02**

Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data from a File

Unit-5: The Object-Oriented Approach: Classes, Methods, Objects. **No. of lectures-03**

Basic concepts of object programming, A short journey from procedural to object approach, Properties, Methods, Inheritance - one of object programming foundations.

Unit-6: Python Standard Library Modules and Packages **No. of lectures-02**

Regular expression operations, Basic date and time types, General calendar-related functions, Container datatypes, NumPy, Shallow and deep copy operations, Mathematical functions.

Internal Continuous Assessment (ICA)

1. Two computer programs on data types, variables, basic input-output operations, basic operators.
2. Two computer programs on control structures.
3. Two computer programs Loops, Lists data types.
4. Two computer programs on Functions.
5. Two computer programs on Dictionary data type.
6. Two computer programs on Modules, Package and String
7. Tny two computer programs on Tuple data type.
8. Two computer programs on Object-Oriented Approach: Classes, Methods and Objects
9. WAP using Inheritance Concept.
10. Two computer programs on the Standard Objective Features; Exception Handling and Working with Files.

* Note: Use suitable Python IDE.

Text Books:

1. e-Resource: Python 2.7.16 documentation https://docs.python.org/2/
2. e-Resource: Python 3.7.3 documentation https://docs.python.org/3/
3. Programming in Python 3, Second Edition, Mark Summerfield

Reference Books:

1. Python Cookbook, Third Edition, David Beazley and Brian K. Jones, Shroff Publishers
2. Distributors Pvt. Ltd., ISBN: 978-93-5110-140-6
3. Learning Python FIFTH EDITION Mark Lutz
4. Programming Python (English) 4Th Edition Mark Lutz
5. Testing Python, David Sale, Wiley India (P) Ltd., ISBN :978-81-265-5277-1

e-resources:

1. Python 2.7.16 documentation - https://docs.python.org/2/
2. Python 3.7.3 documentation - https://docs.python.org/3/

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.TECH. (Mechanical Engineering)

Semester- V

ME 317: Mechanical Workshop – II

Teaching Scheme
Practical: 02Hours/week, 01 Credit

Examination Scheme
ICA: 50 Marks

Course Introduction:
This course is important to understand fundamentals of machine shop starts from safety measures, practical use of measuring tools, use of all conventional machine tools, operations of all conventional machines, use of tolerances, fits and finally their practical use and applications.

Course Objectives:
The course aims to:

1. Learn and understand different machining operations practically studied in theory subjects.
2. Get hands on experience of machining operations such as grinding, drilling, shaping, turning etc.
3. Develop skills to operate different machine tools.
4. Apply tolerances on job.

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

1. Grind the tools.
2. Operate different machine tools such as grinders, lathes, milling, drilling machines etc.
3. Machine the component as per specified dimensions.
4. Apply tolerances on job.

Course Contents

1. Tool grinding demonstration and actual grinding to understand the tool geometry (01 turns)
2. One composite job in M.S. consisting of one component and inclusive of following operation shall be performed by students (Any 5 Operations)
3. Facing, Turning, Step turning, Chamfering, Grooving, drilling, Knurling.
4. At least one dimension of the job shall carry close tolerance (04 turns)
5. Preparation of process sheet for the above job (01 turn)

Note : Students shall prepare a work book involving brief write up regarding machine/machines employed for job. Students should prepare a work book which involves a process sheet for each job and inspection report of the job. Based on the job performed, attendance record, work book, internal viva, faculty may carry internal assessment.

Text Books:

1. Workshop Technology (Volume VI) by Raghuvanshi.
2. Workshop Technology (Volume VI) by Hajra Chowdhary.
3. Workshop Technology (Volume VI) by W.A.J. Chapman
4. Production Technology by P. C. Sharma.
5. Production Technology – HMT Handbook.
6. Production Technology (Volume VI) by Gupte - Patel.
7. P. L. Jain, Principles of Foundry Technology.
8. P.N. Rao, Manufacturing Technology: Foundry, Forming and Welding.

Reference Books

1. Manufacturing Processes & systems by Phillip F. Ostwald, Jairo Munoz-Wiley India.
2. Fundamentals of modern Manufacturing by Mikel P. Groover-Wiley India

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.TECH. (Mechanical Engineering)

Semester-V

ME 318 : Metrology

Teaching Scheme
Practical : 02Hours/week, 01 Credit

Examination Scheme
POE : 25 Marks
ICA : 25 Marks

Course Introduction:

The students of Mechanical Engineering branch are basically concerned with manufacturing various machine components in shops as per given drawing. Today the industrial processing and manufacturing techniques have become complex and complicated and their control is very much difficult by human judgment only. Therefore, the exact and precise measurements are the basic need of the industries. This course of Metrology & Instrumentation, therefore, provides required knowledge and skills and creates self confidence in students so that they can work on shop floor independently for accurate and precise measurements and manufacturing.

Course Objectives:

The course aims to:

1. Calibrate the instruments like vernier calliper and micrometer.

2. Perform angle measurement using a sine bar.

3. Measure various gear tooth elements using gear tooth vernier caliper.

4. Use dial indicator to check Lathe machine parameters like parallelism, squareness, alignment

5. Measure effective diameter of a screw thread.

6. Select adequate limits and fits for various applications.

Course Outcomes:

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

1. Calibrate the instruments like vernier calliper and micrometer.

2. Perform angle measurement using a sine bar.

3. Measure various gear tooth elements using gear tooth vernier caliper.

4. Use dial indicator to check Lathe machine parameters like parallelism, squareness, alignment etc.

5. Measure effective diameter of a screw thread.

6. Select adequate limits and fits for various applications.

Internal Continuous Assessment (ICA):

Any six from the following to be completed and two assignments are compulsory

1. Calibration of Vernier caliper and micrometer.
2. Angle measurement using Sine bar or sine centre in combination with slip gauges
3. Measure gear tooth elements using gear tooth vernier caliper.
4. Use dial indicator to check Lathe machine parameters like parallelism, squareness, alignment or measure run out of a cylindrical component.
5. Use of floating carriage micrometer to measure minor, major and effective diameter of screw thread.
6. Measure effective diameter of a screw thread using a profile projector
7. A visit to a metrology laboratory in an industry

List of Assignments:

1. Assignment based on Limits, Fits
2. Assignment based on gauge design.

Text Books:

1. Gupta. I.C., Engineering Metrology", Dhanpatrai Publications, 2005.
2. Jain R.K., Engineering Metrology", Khanna Publishers, 2009.
3. Rajput R K, Measurement and Metrology", S K Kataria and Sons, 2013.
4. A K Bewoor and V A Kulkarni, Metrology and Measurement, McGraw Hill Education (IND) Pvt Ltd, 2017

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-VI

ME 321 : Transmission System Design

***Teaching Scheme**	***Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks
	OE : 25 Marks

Course Introduction:

This course seeks to provide an introduction to design of various machine elements required in transmission system and discusses various design procedures, requirements and design methods. It introduces the design procedure for various types of gears like spur gear, helical gear, bevel gear and worm gear along with the introduction to AGMA standard. The different types of bearings, their significance and the selection of the rolling contact bearings from Manufacturer's Catalogue and the design considerations for sliding contact bearing are also included in the course content. Design of friction drives such as clutches and brakes is included

Course Objectives:

The course aims to:

1. Apply the process of design of the Spur gears.
2. Apply the helical gear design process.
3. Apply the design process for the bevel gear.
4. Apply the design process for the Worm gear.
5. Select the suitable bearing for particular application from manufacturer’s catalogue.
6. Apply the design concepts of clutches and brakes.

Course Outcomes:

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

1. Design the spur gear considering criterion of bending and wear for particular application.
2. Design the helical gear considering criterion of bending and wear as per required application.
3. Design the Bevel gear considering criterion of bending and wear at particular location.
4. Design the worm gear considering criterion of strength, wear and thermal as per requirement.
5. Select the bearing from manufacturer’s catalogue and to use for suitable application.
6. Calculate of dimensions of clutches and brakes required for an application

Section I

Unit-1: Spur Gears **No. of lectures-08**

Design considerations of gears, gear materials, types of gear tooth failures, hunting tooth, gear tooth loads, minimum number of teeth, face width, Lewis equation, Spott's equation, Buckingham's' Equation (Introductory treatment), gear design for maximum power transmission, Introduction to AGMA code.

Unit-2: Helical Gears **No. of lectures- 04**

Introduction to helical gears, Virtual number of teeth, force analysis, Design of helical gears based on beam strength and wear considerations Pressure angle in the normal and transverse plane. Effective load on gear tooth.

Unit-3: Worm Gears **No. of lectures- 08**

Terminology and geometrical relations, materials, standard dimensions and recommendations of worm gearing, force analysis of worm drive, friction in worm gear, efficiency and design criteria of worm drive as per IS7443-1974, load rating of worm drive, strength and wear rating of worm gear, thermal considerations in worm drive.

Section II

Unit-4: Bevel Gears **No. of lectures- 05**

Introduction to bevel gears, Terminology and geometrical relation, Virtual number of teeth**,** force analysis, mounting of bevel gears, Design of bevel gears based on beam strength and wear strength, dynamic tooth load. Effective load on gear tooth.

Unit-5: Rolling Contact and Sliding Contact Bearings **No. of lectures-10**

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. Ball and Roller bearing, Design for variable load and speed, Bearings with probability of survival other than 90 %.Lubrication and mountings, dismounting and preloading of bearings.

Sliding contact Bearing: Bearing material and their properties, bearing types and their construction details, Hydrodynamic lubrication: Performance analysis of Hydrodynamic bearing by Raimondi and Boyd method. Introduction to hydro static bearings (Introductory Treatment).

Unit-6: Friction clutches and Brakes **No. of lectures-05**

Clutches: Design of plate clutches (Single plate and Multi-plate clutch),coneclutches,centrifugal clutch, Energy equation and thermal considerations in clutches.

Brakes: Introduction, Energy equations, Band and Block brakes , external shoe brakes , Internal expanding shoe brake, Disc brake, thermal considerations**.**

Internal Continuous Assessment (ICA):
List of Experiments/Assignments/Case Studies, etc.
(1- mandatory and any 7 out of remaining 9)

1. Design and drawing gear box using design data book.
2. Practice examples on design of spur gear.
3. Practice examples on design of helical gear.
4. Practice examples on design of bevel gear.
5. Practice examples on design of worm gear.
6. Practice examples on design of clutches.
7. Practice examples on design of brakes
8. Assignment on Rolling contact bearing
9. Assignment on sliding contact bearing
10. A case study on failure analysis of gear

Text Books:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2017.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", Tata McGraw-Hill.

Reference Books:

1. Machine Design by Robert L. Norton.
2. Machine Design by Hall, Holowenko, Schaum's outline series.
3. Hand book of Mechanical Design, 2nd Edition, Gitin Maitra, L. Prasad "Tata McGrawHill,
4. Design of Machine Elements, C.S.Sharma, Kamlesh Purohit, Prentice Hall of India, Pvt. Ltd.
5. Design of Machine Elements M. F. Spotts, T. E. Shoup and L. E. Hornberger, 8th Edition, Printice Hall, 2003.
6. PSG Design Data Book

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-VI

ME 322 : Instrumentation and Control Engineering

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

In recent years, importance of Instrumentation & Control systems has been rapidly increasing in all fields of engineering. The applications of Instrumentation & Control cover a very wide range, from design of precision control devices such as delicate electronic equipment to the design of massive equipments such as those are used for the manufacture of steel or other industrial processes. The principles of control theory are applicable to the engineering as well as non – engineering fields.

Course Objectives:

The course aims to:

1. Analyse the generalised measurement system, identify various static & dynamic characteristics of instruments, make use of various measuring instruments for measurement of temperature, pressure and vacuum.
2. Use various measuring instruments for measurement of displacement, speed and flow.
3. Use various measuring instruments for measurement of Force, torque and strain.
4. Identify manual & automatic control systems, open and closed loop systems, various modes of control, to apply block diagram algebra to determine transfer function of a given control system
5. Construct Root Locus for a given control system and comment on system stability.
6. Construct Bode Plots for a given control system and comment on system stability.

Course Outcomes:

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

1. Analyse the generalised measurement system, identify various static & dynamic characteristics of instruments, make use of various measuring instruments for measurement of temperature, pressure and vacuum.
2. Use various measuring instruments for measurement of displacement, speed and flow.

3. Use various measuring instruments for measurement of Force, torque and strain.
4. Identify manual & automatic control systems, open and closed loop systems, various modes of control, to apply block diagram algebra to determine transfer function of a given control system
5. Construct Root Locus for a given control system and comment on system stability.
6. Construct Bode Plots for a given control system and comment on system stability.

Section I

Unit-1: Introduction to Instrumentation, Temperature & Pressure Measurement **No. of lectures-08**

Generalized measurement system & its functional elements, Static & Dynamic characteristics and terms, calibration, classification of sensors & transducers.
Measurement of Temperature : Concept of Temperature, scales, Thermometer, Thermocouples, RTDs, Thermistors, Measurement of Pressure & vacuum : Terminology of pressure & vacuum, Bourdon tube, Deadweight pressure gauge, Diaphragm gauge, Vacuum gauges- McLeod's gauge, Ionization gauge

Unit-2: Measurement of Displacement, Speed and Flow **No. of lectures-06**

Measurement of Linear Position & displacement : Potentiometer, LVDT
Angular Speed Measurement : Mechanical Tachometer, Inductive pickup, Photoelectric pickup, Stroboscope, Measurement of fluid flow : Rate meters and Quantity Meters, Turbine Meter, Rotameter, Domestic Watermeter, Hot wire anemometer

Unit-3: Measurement of Force, Torque and Strain **No. of lectures-06**

Force measurement : Hydraulic & Pneumatic Load Cells, Proving Ring , Torque Measurement using dynamometers, Types of dynamometers, Strain gauges, Classification, Relation for Gauge Factor, Strain gauge load cell, half bridge and full bridge network circuits

Section II

Unit-4: Fundamentals of Automatic Control No. of lectures-0**8**

Control – Need, Control System, Manual and automatic control systems, Open loop and Closed loop (feedback) control systems, Modes of Control : P - Control, P+I Control, P+I+D Control, Block diagram Algebra: General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block diagram to obtain closed loop transfer function.

Unit-5: Root Locus method **No. of lectures-06**

Significance of Root locus, angle and magnitude conditions, pole-zero plot, sections of R.L. on the real axis, Asymptotes & Centroid, breakaway points, intersection with imaginary axis, angles of departure and arrival, construction of root locus (on graph paper) using general rules and steps, comment on stability

Unit-6: Bode Plots **No. of lectures-06**

Magnitude and Phase angle plots, standard form of open loop T.F. G(jω) H(jω), Bode plots for standard factors of G(jω) H(jω),steps to sketch Bode plots for following factors :System gain K, Poles & zeroes at the origin, simple poles & simple zeroes, frequency response specifications, Construction of Bode plots using a semilog paper, calculation of Gain Margin and Phase margin, comment on system stability

Internal Continuous Assessment (ICA):

Part-A Any four of the following experiments to be completed :

1. Temperature Measurement using thermocouples, RTD, Thermistor.
2. Testing of mechanical pressure gauge using Dead Weight pressure tester.
3. Vacuum measurement using U tube manometer & Mechanical Vacuum Gauge.
4. Displacement Measurement using LVDT
5. Angular speed measurement using mechanical tachometer, stroboscope, photoelectric pickup, inductive pickup.
6. Flow measurement using Rotameter.
7. Measurement of bending strain or load using strain gauges.
8. Force Measurement using proving ring, load cells.
9. Measurement of torque by a dynamometer

Part-B Any four of the following to be completed

1. An experiment on DC/AC motor speed control (open loop / closed loop)
2. An experiment to demonstrate various modes of control: P, P+I, P+D & P+I+D.
3. Assignment on determination of transfer function using block diagram algebra
4. Assignment on construction of root locus for a given representation of a feedback control system
5. Assignment on construction of Bode Plots for a given representation of a feedback control system

Text Books:

1. Mechanical Measurement & Control: Dr. D. S. Kumar
2. Automatic control Engineering: F. H. Raven., McGraw Hill International editions, New Delhi, Fifth edition.

3. Control Systems: U.A. Bakshi and V.U. Bakshi : Technical Publications, Pune, Fifth revised Edition –2007.

Reference Books

1. Mechanical Measurements : Dr Sirohi & Dr. Radhakrikshan.
2. Mechanical Measurements : Beckwith & Buck
3. Modern Control Engineering: K.Ogata, Prentice Hall of India Pvt. Ltd., New Delhi., 4th Edition.
4. Process Control: C. Johnson: Prentice Hall of India Pvt. Ltd., 1996.

PunyashlokAhilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-VI

ME 323 : Heat Transfer

Teaching Scheme
Lectures:03Hours/week, 03Credits
Practical :02Hours/week, 01Credit

Examination Scheme
ESE: 70Marks
POE: 25 Marks
ISE: 30Marks
ICA: 25Marks

Course Introduction:

This course deals with study of various modes of heat transfer such as conduction, convectionand radiation. After completing the course, the students will be able to formulate and analyzea heat Transfer problem involving any of the three modes of heat transfer. The students willbe able to obtain exact solutions for the temperature variation using analytical methods wherepossible or employ approximate methods or empirical correlations to evaluate the rate of heattransfer.The students will be able to analyze the performance of devices such as heat exchangers andalso estimate the insulation needed to reduce heat losses wherever necessary.

Course Objectives:

The course aims to:

1. To classify and study the important modes of heat transfer.
2. To formulate and apply the general three-dimensional heat conduction equations t
3. To elaborate the mechanism of radiative heat transfer
4. To elaborate the mechanism of convective heat transfer
5. To demonstrate and explain mechanism of boiling and condensation.
6. To describe the various two-phase heat transfer phenomenon

Course Outcomes:

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

1. Compare and distinguish the Modes of heat transfer.
2. Apply the laws of conduction heat transfer to the analysis
3. Apply the different laws to the radiation heat transfer.
4. Analyze heat transfer in case of natural & forced convection
5. Explain heat transfer in boiling & condensation.
6. Analyze the effectiveness, rating of heat exchangers.

Section I

Unit-1: Conduction **No. of lectures-08**

Modes of Heat Transfer-

Modes of heat transfer. Basic laws of heat transfer, Thermal conductivity and its variation with temperature for various Engineering materials (Description Treatment).

Steady State Heat Conduction-

Derivation of Generalized Heat Conduction equation in Cartesian co-ordinate & its reduction to Fourier, Laplace and Poisson's equations. Generalized Heat conduction equation in cylindrical and spherical coordinates (no derivation) and its reduction to one-dimension (1D) heat conduction through plane wall, cylinder, sphere. Heat Transfer Applications: composites, critical radius of insulation for cylinder and sphere. One dimensional steady state heat conduction with uniform heat generation for wall & cylinder (Numerical Treatment)

Unsteady State Heat Conduction-

Systems with negligible internal resistance, Biot and Fourier number and their significance, Lumped Heat capacity Analysis (Numerical Treatment)

Unit-2: Extended Surfaces **No. of lectures- 04**

Types and applications of fins, Governing equation for constant cross section area fins, Solution for fins with convective tip, adequately long (with insulated end) and infinitely long. Fin effectiveness and efficiency (Numerical Treatment)

Unit-3: Radiation **No. of lectures-08**

Nature of thermal radiation, definitions of absorptivity, reflectivity, transmissivity, monochromatic emissive power. Total emissive power and emissivity, Concept of black body& gray body, Kirchhoffs law, Weins law and Plancks law. Lambert cosine rule, Intensity of radiation. Energy exchange by radiation between two black surfaces with non-absorbing medium in between and in absence of reradiating surfaces.

Concept of radiation shape factor and its properties (Description only). Energy exchange by radiation between two gray surfaces without absorbing medium and absence of reradiation and Radiosity. Radiation network method, network for two surfaces which see each other. (Numerical Treatment)

Section II

Unit-4: Convection **No. of lectures- 08**

Forced Convection-

Mechanism of convection and its types, Concept of Hydrodynamic and thermal boundary layer, local and average convective coefficient. Dimensional analysis, dimensionless numbers and their physical significance, Empirical correlations for internal and external flow in forced convection problems. (Numerical Treatment)

Natural Convection-

Introduction, Dimensional analysis, dimensionless numbers and their physical significance, Empirical correlations for natural convection problems. (Numerical Treatment)

Unit-5: Boiling and condensation **No. of lectures-06**

Boiling Heat Transfer, types of boiling, Pool boiling curves, Force boiling phenomenon, Condensation Heat transfer, Film wise and drop wise condensation. Introduction of Heat pipe (Construction, working, advantages and applications) (Descriptive Treatment)

Unit-6: Heat Exchangers **No. of lectures-06**

Classification & Types of Heat exchangers, Fouling factor, and Overall heat transfer coefficient, Analysis by LMTD and NTU method for parallel and counter flow, Design consideration for Heat exchangers. (Numerical Treatment).

Internal Continuous Assessment (ICA):

Any 08 Experiments based on following list

1. Determination of thermal conductivity of insulating powder.
2. Determination of thermal conductivity& thermal resistance of Composite wall .
3. Determination of thermal conductivity of metal rod .
4. Determination of Heat Transfer Coefficient for natural convection.
5. Determination of Heat Transfer Coefficient for forced convection.
6. Determination of Emissivity of test plate.
7. Determination of Stefan Boltzmann Constant.
8. Determination of critical heat flux in boiling heat transfer.
9. Determination of heat transfer coefficient in dropwise and film wise condensation.
10. Determination of LMTD and effectiveness of Heat Exchanger.
11. Heat Pipe Demonstration/Trial.
12. Determination of temperature distribution, fin efficiency in Natural /forced convection.
13. Computer programme for any one of the above experiment.

Instructions for Practical Exam:

1. Four to Five experiments may be selected for Practical Examination.

2. The Number of Students for each practical set up may not be more than 04 Students.

Text Books:

1. A Text Book on Heat Transfer by Dr. S. P.Sukhatme, Orient Longman Publication, Hyderabad
2. Heat Transfer by P.K. Nag, Tata McGraw hill Publishing Company Ltd., New Delhi.
3. Engineering Heat and Mass Transfer, Mahesh M.Rathore,University Science Press, New Delhi-110002

4. Heat and Mass Transfer by Dr. D. S.Kumar S.K. Kataria& Sons, Delhi.
5. Heat and Mass Transfer, S.C. Arrora and S. Dokoundwar, DhanpatRai and Sons, Delhi.

Reference Books

1. Heat Transfer by J.P. Holman , McGraw Hill Book Company, New York.
2. Fundamentals of Heat and Mass Transfer by R.C. Sachdev, Willey Eastern Ltd.,
3. Heat Transfer – A Practical approach by – Ynus -A – Cengel(TatacGraw Hill)
4. Fundamentals of Heat & Mass Transfer (Fifth Edi.), Frank P.Incropera, David P.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-VI

ME 324 : Industrial & Quality Management

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 01 Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

Industrial management involves studying structure and organization of industrial organisations. The knowledge of Industrial management comprises of those fields of business administration that are necessary for the success of companies within manufacturing sector and the encompassing services (primarily operations management, marketing and financial management). This subject is having two sections wherein, Section I is about general functions of Management applicable to industrial & other organizations whereas Section II contains concept of quality, total quality management and Quality control tools and techniques applicable to understand quality issues in manufacturing and service industry.

Course Prerequisite:

1. Knowledge of various manufacturing process.
2. Knowledge of industrial working environment through industrial training and Industrial visits.
3. Mathematics concepts, Probability Basics, Analytical Approach with exposure to industrial activities.

Course Objectives:

The course aims to :

1. To give the students an overview of the general functions of Management applicable to industrial & other organizations
2. To give insight to the philosophy & techniques of quality management applicable to industry
3. To make students aware about different motivational techniques and leadership styles
4. To give the students overview of working of various departments
5. To introduce various statistical process controls to students

Course Outcomes:

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

1. Understand basics of Industrial Management and their functions.
2. Discuss and demonstrate management functions to various organisations.
3. Explain and apply various quality control/statistical tools for industrial / organizational problems.
4. Understand working of various departments in industry
5. Understand various tools and techniques of total quality management used in industry

Section I

Unit-1: Introduction to Management and Industrial Functions: No. of lectures-06

Nature, purpose & scope of Management. System's approach to Management, Functions of Managers, Social responsibility & Ethics in Managing.

Introduction to Industrial Organizations: Production /Operations Management, Marketing Management, Financial Management

Unit-2: Planning, Organizing and Staffing No. of lectures-08

Planning: Meaning, Types of plans, steps in planning, planning process, decision making.

Organizing: Nature & purpose of organizing, Organization structure, Span & levels, Departmentation, Authority & responsibility, centralised Vs decentralised organisation.

Staffing: Definition, Human resource management & selection, Performance appraisal, Training & development.

Unit-3: Leading and Controlling No. of lectures-06

Leading: Human factors in managing, Motivation, 'Carrot & Stick' theory, Maslow's theory of Hierarchy of needs, leadership styles, communication: process. Types- oral, written & nonverbal.

Controlling: Process of controlling, control techniques.

Section II

Unit-4: Introduction to Quality No. of lectures-08

Definition of Quality, Elements of quality, quality specifications. Factors affecting quality of design & quality of conformance, quality control, quality costs.

Benchmarking, Quality Management Systems, Environmental Management System

Unit-5: Total Quality Management No. of lectures-06

Quality Gurus, Customer satisfaction, continuous process improvement, employee involvement, supplier partnership, Tools of quality control: Check sheets, graphs, Pareto analysis, cause & effect diagram, Scatter diagram, control charts, Six Sigma.

Unit-6: Statistical Process Control No. of lectures-06

Introduction to SPC, Control charts for variable & attributes, interpretation & applications of X-bar, R, P & C charts, Process capability. Acceptance sampling, sampling plans- types single & double, Operating characteristic curve, Producer & consumer risks. (Numerical treatment only on P & C charts and on sampling plans)

Internal Continuous Assessment (ICA):
List of Experiments/Assignments/Case Studies, etc.
Minimum 8 assignments based on above topic out of which 2 case studies related to industry /organisation.

Text Books:
1. Essentials of Management – Koontz Weihrich By TMH
2. Principles of Management & Administration – D. Chandra Bose. PHI
3. Statistical Quality Control – M. Mahajan By Dhanpat Rai & Co.
4. Total Quality Management – Besterfield & Others PHI

Reference Books
Principles of Management – Tripathy, Reddy by TMH

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Third Year B.Tech. (Mechanical Engineering)
Semester-V
Professional Elective –IV
ME 325 (A) : Project Management

Teaching Scheme
Lectures : 03 Hours/week, 03 Credits
Practical : 02 Hours/week, 01 Credit

Examination Scheme
ESE : 70 Marks
ISE : 30 Marks
ICA : 25 Marks

Course Introduction:

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. It is broken into five different categories like planning, scheduling, monitoring and controlling. Some software might be used to help or manage various projects, with each project having unique requirements.

Course Objectives:

The course aims to:

1. To understand the concepts of Project Management for planning to execution of projects.
2. To carry out the feasibility analysis in Project Management using analysis tools for risk, cost estimation.
3. To enable for the use of planning, scheduling, monitoring and controlling methods in Project Management
4. To make them capable to analyze, apply and appreciate contemporary project management software available in market.

Course Outcomes:

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

1. Describe concept, importance & Professional responsibilities of project management
2. Implement various techniques used to analyze risks in the projects.
3. Use various techniques used for cost estimation of a project.
4. Use methods for planning and scheduling of a project
5. Use methods for monitoring and control of a project.
6. Understand use of computer Applications at various stages of a project.

Section I

Unit-1: Introduction to Project Management **No. of lectures-** 06

Definition & Characteristics of Project, Classification of Projects, Project Management, Benefits, Project Management Process, Role of Project Manager. Project Lifecycle.

Unit-2: Project Management Techniques and Risk Management **No. of lectures-** 08

Feasibility Studies, Numerical Models (Payback Period, Return on Investment, Net Present Value, Internal rate of Return), Scoring Models, Break Even Analysis.

Project Risk Management: Introduction of Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks.

Unit-3: Project Cost Estimating **No. of lectures-** 06

Estimating terminology, Project Costs, Estimating Methods (Jobbing, Factoring, Inflation, Economies of Sales, Unit Rates, Day Work), Analogous Estimating, Parametric Estimating, Bottom-Up Estimating, Three-Point Estimates, Monte Carlo Simulation, Project Budgeting, Resource Allocation, Cost Forecasts.

Section II

Unit-4: Project Planning and Scheduling **No. of lectures-**06

Project Planning: Introduction, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)

Scheduling: Introduction, Development of Project Network, Time Estimation, Determination of the Critical Path, PERT Model (Numerical Treatment)

Unit-5: Project Monitoring and Control **No. of lectures-**08

Project Execution and Control: Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control.

Project Management Information System: Introduction, Project Management Information System (PMIS), Planning of PMIS, Design of PMIS.

Project Performance Measurement and Evaluation: Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects

Unit-6: Computer Applications in Project Management **No. of lectures-**06

Introduction to MS Projects – Understanding the MS Project screen & different views, Defining the project, Working with calendar, Outline the project, Create dependencies between tasks, Creating WBS, Format task list and Gantt chart, Resource planning, leveling and preparing resource graph, Working with baseline, tracking the project.

Use of excel and MS project for feasibility studies, risk management, project cost estimating, project planning and scheduling etc.

Internal Continuous Assessment (ICA):

Total Eight Assignments**.**

1. (Six Assignment) One assignments on each unit: Including numericals
2. Two case studies: project cost estimation and project scheduling

Text Books:

1. S. Choudary, Project Management, Tata McGraw Hill
2. Narendra Singh; Project Management & Control; Himalaya Publishing House, Mumbai

Reference Books

1. Maylor, Project Management, Pearson Education,
2. Project Management Institute; "A Guide to the Project Management Body of Knowledge (PMBOK Guide)"; 5th Revised edition (1 January 2013)
3. Harold Kerzner; "Project Management: A Systems Approach to Planning, Scheduling and Controlling Paperback"; Wiley; tenth edition (20 November 2012)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-VI

Professional Elective -IV

ME 325 (B) : Industrial Product Design

***Teaching Scheme**	***Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

Industrial design is a creative discipline focused on solving a real world problems with a blend of art and design, Technology, and science. This drives innovation through a combination of practical ideas and scientific processes. Industrial design is concerned with bringing artistic form and usability, usually associated with craft design and ergonomics, together in order to mass produce goods. The knowledge of industrial product design helps to understand and satisfy the need of customer by considering cost quality and flexibility

Course Objectives:

The course aims to:

1. Impart knowledge and skill sets required for industrial design profession which includes ergonomic and aesthetic in design.
2. Enable students to understand industrial design practices includes new product design.
3. Enable students to understand rule of design engineer which impact at National and international level.

Course Outcomes:

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

1. Apply product design process to industrial and consumer products
2. Use aesthetic and ergonomic concepts in product design
3. Implement critical and creative thinking in design of products.
4. Apply Design Thinking for Problem Solving
5. Create Models/Prototypes using 3D Design Tools
6. Analyse Ergonomics, Aesthetic & Economical viewpoints of Product.

Section I

Unit-1: An approach to Industrial Ddesign **No. of lectures-08**

Technical requirements, Ergonomic requirements, Aesthetic requirements. Economic Requrements, industrial and Anthropometric data, ergonomical design aspect of machine tools; testing machines; instruments; automobiles; process equipments.

Unit-2: visual effects and line and form **No. of lectures-06**

Mechanics of seeing, psychology of scene, general inferences of line and form colour and light, colour terms, colour combinations, Colour of Engineering equipment, colour of machines and their forms.

Unit-3: aesthetic concepts **No. of lectures-06**

Concept of unity, Concept of order with variety concept of purpose style and environment aspiration, symmetry, balance, User Experience Case Studies in Industrial Design

Section II

Unit-4: Industrial Design in Practice **No. of lectures-06**

General Design situation, specifying design requirement, Benchmarking with Competitors, Quality Function Deployment QFD, Introduction to Business Model Canvas, TAM or Total Available Market,SAM or Serviceable Available Market SOM or Serviceable Obtainable Market. Types of Market Survey influencing industrial design, production

Unit-5: New product development **No. of lectures-08**

Introduction to Patent search patent database for example IP India patentability Search, patentscope,ESPACENET, Design Thinking (DT), Steps in Design Thinking process, EMPATHISE,DEFINE,IDEATE,PROTOTYPE,TEST, CASE Studies of Products Developed by DT, Design for Manufacturing and Design for Assembly (DFM & DFA)

Unit-6: Decision Making and Computer Aided Product Design **No. of lectures-06**

Decision Making optimization, probability, reliability with computer aided product design, Additive Manufacturing

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Assignment on Product Specification (Two Case Studies)
2. Assignment on Aesthetic & Ergonomical Considerations for Assignment 01 (Two Case Studies)
3. Assignment on Developing Paper Prototype of Selected Two Case Studies
4. Assignment on Nature Inspired Form & Colours
5. Assignment on Applications of Design Thinking
6. Case study design of new product – Devices, utility products, concept generation and evaluation using different methods
7. Product Modelling Using 3D Modelling Design Software
8. Prepare Business Model Canvas for Product

Text Books:

1. Product Design & Development by Karl T Ulrich,Stevan Eppinger
2. Industrial Designs for Engineers – W.H.Yali
3. Product Design – Otto- Pearson Publication
4. Creative Confidence by Tom Kelly & David Kelly IDEO

Reference Books

1. Grassroot Innovations by Anil Gupta

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.TECH. (Mechanical Engineering)

Semester-VI

Professional Elective – IV

ME 325 (C) : Plastic Engineering

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

During this course, student is exposed to following knowledge-

1. Study of extraction, manufacturing of plastic material and classification.
2. Study of various properties of plastic materials, comparative study of the plastics on the basis of parameters like structure, cost and processing time etc.
3. Study and Comparison of the different processes on the basis of parameters like design of plastic part, cost and processing time etc.
4. Design of plastic part, die/molds, correct selection & design leads to compact & less cost of systems.

Course Objectives:

The course aims to:

1. To understand the mechanism of polymerization, techniques of polymerization
2. To provide the depth knowledge about different kinds of plastic materials based on their structure and properties.
3. To make the students familiar about properties and processing of plastics and use it for different applications.
4. To provide the depth knowledge about plastic product design and different kinds of die/mould design.

Course Outcomes:

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

1. Predict the structure and properties of different kind of plastic material and select the plastic materials for particular end user application.
2. Know the processing of different plastic material based on the end user requirement.
3. Design the plastic products
4. Design compression and transfer molds
5. Design Injection Moulds
6. Design plastic injection mould for cooling

Section I

Unit-1: Study of *Plastic Materials* **No. of lectures - 06**

Definition and Classification of Plastic Materials, Properties of plastics, applications, Testing methods for plastics, additives in plastics, Monomers & Polymers, Polymerization - Types of Polymerization.

Introduction to composite plastics, Introduction of polymer degradation and biodegradable plastics, advanced application like Agriculture, Packaging, Building, Transport, Electrical, Electronics, Medical and Furniture.

Unit-2: Processing of Plastics and Welding of Plastics **No. of lectures - 07**

Processing of Plastics:

Injection molding, Extrusion molding, sheet forming processes, calendaring, Blow molding, Processing of thermosetting plastics, compression molding, Transfer molding, rotational molding.

Welding of Plastics:

Hot gas welding, hot tool welding, High frequency induction welding, laser welding, Infrared welding, ultrasonic welding, friction welding.

Unit-3: Design of Plastic Parts **No. of lectures - 07**

Basic design features, Tolerances of molded plastics parts, allowances in plastics, Design corners, undercuts, curing time, ribs, minimum wall thickness, design of inserts, cores mold materials.

Section II

Unit-4: Design of compression and transfer molds **No. of lectures – 08**

a) Design and main parts of compression mould, standard insert mould body, design of loading chamber, design of punch, ejectors, stripper guided pin.

b) Technology of transfer mould, types, main parts, automation in transfer mould.

Unit-5: Injection Mould Design **No. of lectures – 06**

Injection mould design, Single, multi cavity, semi-automatic and automatic moulds. Types of injection mould, detailed structure and working. Feed system, Temperature control system, Ejection System, application.

Unit-6: Cooling of plastic injection mould **No. of lectures – 06**

Determining the heat quantity dissipated with cooling, heat dissipation with natural cooling, mean temperature, thermal resistance of mold body, summery of dimension and construction of correct cooling system.

Internal Continuous Assessment (ICA):
List of Experiments/Assignments/Case Studies, etc.

1. Study of plastic material- Polymerization, properties and specific applications in wide areas.
2. Design of Plastic product.
3. Injection mould design for simple component.
4. Design of Compression mould.
5. Design of Blow Mould.
6. Two Case studies for mould manufacturing-At least one case study with any CAD/CAM software.
7. Study and applications of advanced Plastics.
8. Industry Visit to Plastic part manufacturing Units (Min. Two Units).

Text Books:

1. Prof.(Dr.) Sanjay K Nayak, Fundamentals of Plastics Mould Design, Tata McGraw Hill Education Private Limited, New Delhi.

Reference Books

1. J. A. Brydson, “Plastics Materials”, Butter worth Heinemann Oxford,1999
2. Schwartz & good man “Plastics materials and processing”
3. Irwin Rubin “Hand book of Plastic Materials and Technology”
4. Fred W. Billmeyer, JR., “Text Book of Polymer Science”, John Wiley & Sons, Singapore, 1994
5. Charles A. Harper, “Handbook of Plastic Processes”, WILEY India Pvt.Ltd.,2014
6. R.C.Batra, “Comprehensive Injection Moulding”, CBS Publishers and Distributors Pvt. Ltd., 2011

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-VI

Professional Elective – IV

ME 325 (D) : Railway Transportation

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

This course presents a comprehensive overview of passenger and freight railway transport systems, from design through to construction and operation. Moreover, it thoroughly covers freight railway systems transporting conventional loads, heavy loads and dangerous goods. For each system it provides a definition, a brief overview of its evolution and examples of good practice, the main design, construction and operational characteristics, the preconditions for its selection and the steps required to verify the feasibility of its implementation. This subject includes all means of transport whose rolling systems involve at least one iron component.

Course Objectives:

The course aims to:

1. To make a student understand concepts of various types of railway transport systems.
2. To make a student understand the different aspects of railway engineering, their uses, capabilities and limitations.
3. To introduce track engineering and fundamental calculations for railway tracks.
4. To give students an introduction to rolling stock and their dynamics.
5. To introduce a student to concept of derailment railway systems.
6. To make a student aware about concepts of Wheel Rail behavior.

Course Outcomes:

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

1. Summaries different components of a railway transportation system
2. Interpreting various stresses & deflections generated in track under various loads.
3. Analysis of forces on track due to various loads.
4. Design track under various loads.
5. Interpretation of behavior of railway track with rolling stock.
6. Evaluating derailment of railway vehicles.

Section I

Unit-1: Introduction to Railway Transportation Systems **No. of lectures- 08**

Introduction to railway systems, Components of railway systems: Railway infrastructure, Rolling stock and Railway operation, Fundamental functional principles: Running on a straight path, running in curves, Distinctive features of railway systems, Classification of railway systems. The capabilities of the railway transportation system: Advantages and disadvantages of the railway, Comparison of the characteristics of railway systems, Comparison of the capabilities of different transportation systems.

Unit-2: Behavior of rolling stock on track **No. of lectures- 08**

Behavior of a single railway wheel set: Movement on straight path, Movement in curves, Behavior of a whole vehicle: Operational and technical characteristics of bogies- Object and purposes of bogies, Conventional bogies, Bogies with self-steering wheel sets, Bogies with independently rotating wheels, Bogies with creep-controlled wheel sets, Bogies with wheels with mixed behavior. Wheel rolling conditions and bogies inscription behavior in curves. Lateral behavior of a whole vehicle- Vehicles with conventional bogies, Vehicles with bogies with self-steering wheel sets, Vehicles with independently rotating wheels, Comparative assessment.

Unit-3: Derailment of railway vehicles **No. of lectures- 04**

Derailment of railway vehicles: Definition, Derailment through displacement of track, Derailment as a result of vehicle overturning, Derailment with wheel climb- Description of the phenomenon, Derailment criteria, Factors affecting derailment.

Section II

Unit-4: Vertical loads on track **No. of lectures- 08**

Classification of loads, Vertical loads on track: Static vertical loads- Axle load, Wheel weight, Daily traffic load. Quasi-static vertical loads: Vertical wheel load due to crosswinds, Vertical wheel load due to residual centrifugal force. Dynamic vertical loads- Dynamic vertical wheel load, Total vertical wheel load, Design vertical wheel load, Design loads of bridges.

Unit-5: Transverse loads on track **No. of lectures- 08**

Transverse loads on track: Gravitational forces, Creep forces- Running on straight path, running in curves, Crosswind forces, Residual centrifugal force, Guidance forces, Forces due to vehicle oscillations, Total transversal force.

Unit-6: Longitudinal force Analysis **No. of lectures- 04**

Longitudinal forces: Temperature forces, Rail creep forces, Braking forces: Acceleration forces, Traction forces: Adhesion forces, Fishplate forces.

Internal Continuous Assessment (ICA):
List of Experiments/Assignments/Case Studies, etc.

Minimum Four case studies on:

1. Rail transportation systems
2. Failure of railway tracks
3. FEA analysis of loading conditions of various types of coaches and bogies
4. Advanced electric systems in railways
5. Derailment of railway vehicles

Minimum Four assignments on:

1. Assignment on Railway Transportation System
2. Assignment on Behavior of rolling stock on track
3. Assignment on Derailment of railway vehicles
4. Assignment on Vertical loads on track
5. Assignment on Transverse loads on track
6. Assignment on Longitudinal force Analysis

Text Books:

1. Railway Transportation Systems — Design, Construction and Operation, Christos N. Pyrgidis, 2019, CRC Press
2. A Text Book of Railway Engineering, S.C. Saxena, S.P.Arora, Dhanpat Rai Publications (p) Ltd.-new, Delhi, 2010.
3. Electric Traction for Railway Trains: A Book for Students, Electrical & Mechanical Engineers, Superintendents of Motive Power & Others, E. P. Burch, McGraw- Hill Book Company.

Reference Books

1. Handbook of Railway Vehicle Dynamics, Simon Iwnicki, Taylor & Francis Group, CRC Press, ISBN: 9780849333217, 0849333210
2. Railway Track Engineering, J.S.Mundrey, Tata McGrow Hill Publication. Principles of Railway Engineering, S.C. Rangawala, Charotar Publication, 2015.
3. Traction Rolling Stock- Three Phase Technology, A.K. Rawal, Indian Railway Institute of Electrical Engineering, Nasik Road.
4. Traction Distribution- Power Supply Electric Traction, A.K. Rawal, Indian Railway Institute of Electrical Engineering, Nasik Road.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester-VI

ME 327: Advanced Programming Concepts – II (Java)

Teaching Scheme
Lectures : 01 Hour/week, 01 Credits
Practical : 02Hours/week, 01 Credit

Examination Scheme
ICA : 25 Marks

Course Introduction:

By the end of this course, students will have gained a fundamental understanding of programming in Java by creating a variety of scripts and applications for the Web and for systems development. Java is a programming language, suitable for projects ranging from small scripts to large systems. Students will be able to explore the large standard library of Java, which supports many common programming tasks.

Course Objectives:

The course aims to:

1. To learn the basic syntax and semantics of JAVA.
2. To make students familiar with the general programming concepts of JAVA such as variables branching, loops and functions.
3. To make the students learn and program JAVA scripts.
4. To develop GUI based applications in JAVA

Course Outcomes:

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

1. Install JAVA IDE & develop simple applications using JAVA.
2. Read from and write to text files and debug errors.
3. Write Java code using advanced Java feature
4. Write JAVA applet for windows based applications such as Word & Excel and JAVA scripts for CAD software such as CATIA & AutoCAD.
5. Develop a small JRE based application or Applet for a mechanical engineering subject.
6. Use the syntax and semantics of java programming language and basic concepts of OOP

Section I

Unit-1: Introduction to Java **No. of lectures-2**

Java history, Java features, Java vs. C and C++, Installing Java, Exploring the IDE, Simple Java program, JVM and command line arguments

Unit-2: General Programming **No. of lectures-2**

Constants, Variable and data types, Operators and expressions, Branching and looping, calling object methods, Creating a function. Program plan, assigning static properties & dynamic properties,

Unit-3: OOP **No. of lectures-3**

Define class, methods declaration, creating objects and constructors, Methods overloading, static members, nesting of methods, overriding methods, Final variables and methods, Interfaces and packages

Section II

Unit-4: Interface and packages **No. of lectures-2**

Using packages and interfaces, I/O classes creating files, reading/writing characters

Unit-5: Arrays, Strings and Vectors **No. of lectures-2**

1D and 2D arrays, Strings, Vectors

Unit-6: Debugging & : Applets **No. of lectures-3**

Types of Errors exceptions, Exception handling using catch statements, finally statement

Applets, Applets vs. Applications

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Assignment on Fundamentals of Java programming
2. Programming exercises on Variables and parameters
3. Programming exercises on branching and looping
4. Programming exercises on Console I/O
5. Assignment on object objects, classes and methods
6. Programming exercises on Arrays, strings and vectors

7. Programs on packages and interfaces
8. Programs on Exception handling
9. Assignment on Java Applet

Text Books:

1. Programming with JAVA: A Primer (4th Edition) - E. Balaguruswamy TMH
2. JAVA: The Complete Reference(5th Edition) - Herbert Scheldt (TMH)
3. Essential JAVA for Scientists and Engineers - Malan and Hahn (BH)

Reference Books

1. Object Oriented Programming through JAVA - P. Radhakrishna (University Press)
2. Java Programming for Beginners -Motwani (Shroff Publication)
3. Let us JAVA -Yeshwant Kanetkar (BPB)
4. JAVA in Easy Steps -Mike McGrath (TMH)

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Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Third Year B.Tech. (Mechanical Engineering)

Semester- VI

ME 327: Mechanical Workshop – III

Teaching Scheme
Practical: 02Hours/week, 01 Credit

Examination Scheme
ICA: 50 Marks

Course Introduction:
This course is important to make the students aware of various skills involved in manufacturing & assembly, develop skills to operate different machine tools and make students aware of operation sequence, speed, feed selection for different materials & operations along with their operational set up.

Course Objectives:
The course aims to:

1. Set the manufacturing set up of different machining operations and study the corresponding set up parameters while working on actual machine tools.
2. Select appropriate and proper process parameter for obtaining desired requirement on work piece.
3. Identify the operational / processing problems and suggest remedial solution for adopted manufacturing processes.

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

1. Understand the working of various machines
2. Operate various machine tools.
3. Perform various machining operations.
4. Selection of operational and process parameters during machining operations.
5. Manufacture a small assembly of components.
6. Understand various attachments on various machines.

Course Contents
Any one noncommercial assembly consisting of at least three components with tolerance involving use of lathe, drilling, milling, grinding and any additional machine tool or processes as per requirement. Use machining operations like boring, slotting, tapping, tapering, external taper turning, shaping, milling etc. (Any 5 Operations)

or

Development and Execution of one simple turning/milling job on CNC (Trainer) including geometric and dimensional tolerances.

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Note

1. Students shall prepare a work book involving brief write up regarding machine/machines employed for job.
2. Students should prepare a work book which involves a process sheet for each job and inspection report of the job.
3. Based on the job performed, attendance record, work book, internal viva, faculty may carry internal assessment.
4. Material specification for conventional practical job is Φ32mm MS bar and Material for CNC is as per machine requirement.
5. 5. Development and Execution of CNC job need to cover all fundamentals of CNC programming and its execution.

Text Books:

1. Workshop Technology (Volume VI) by Raghuvanshi.
2. Workshop Technology (Volume VI) by Hajra Chowdhary.
3. Workshop Technology (Volume VI) by W.A.J. Chapman
4. Production Technology by P. C. Sharma.
5. Production Technology – HMT Handbook.
6. Production Technology (Volume VI) by Gupte - Patel.
7. Introduction to CAD/CAM, Rao P.N.
8. CAD/CAM/CAE, Chougule N.K.

Reference Books

1. Manufacturing Processes & systems by Phillip F. Ostwald, Jairo Munoz-Wiley India.
2. Fundamentals of modern Manufacturing by Mikel P. Groover-Wiley India
3. Theory and Practice, Ibrahim Zeid – CAD/CAM - Tata McGraw Hill Publishing Co.
4. CAD/CAM - Mastering, Ibrahim Zeid –-Tata McGraw Hill Publishing Co.

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Punyashlok Ahilyadevi Holkar Solapur University

Third Year B.Tech. (Mechanical Engineering)

Semester-V

ME 328 : Mini Project

Teaching Scheme	**Examination Scheme**
Tutorial : 01 Hour/week, 01 Credit	**ICA : 50 Marks**

Course Introduction: The mini project is designed to help students develop practical ability and knowledge about practical tools/techniques in order to solve real life problems related to the industry, academic institutions and society. This course will also develop investigative, research and report writing skills and will provide an opportunity to investigate a chosen topic in considerable depth. Mini Project provides the opportunity for students to demonstrate the application of their research skills, and to apply their knowledge to complex computing problems. A mini project is an assignment that strengthens the understanding of fundamental knowledge through effective application of theoretical concepts.

Course Objectives:

The course aims to:

1. To identify potential problems in engineering.
2. To Carry out Research about the selected topic.
3. To provide a solution for the problem identified.
4. To express technical ideas, strategies and methodologies in written form.

Course Outcomes:

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

1. Identify and analyze the potential technical problems.
2. Carry out research about the selected topic
3. Seek suggestions from subject experts
4. Carry out planning and its execution with teammates
5. Develop solution for a set of requirements for the problem identified.
6. Write a report with all the contents in logical order and do Quality Presentation

6 Steps to do Successful Mini Project:

1. Selection of Topic

Selection of topic is a huge and important task in a Mini Project. One should have a clear idea about one's subject strengths and the selected topic should be relevant to it. Always select the project that has value addition.

As a graduate you should select a project which is either advantageous to a lot of people or enhance your technical and managerial skills. Your project must play its role towards a positive growth/development in that specific field.

2. Research about the selected topic online

Do some online research about the selected topic. Go through the research papers from different researchers around the world on the topics related to Mini Project. Find some websites containing the information about the materials used for Mini Project.

3. Suggestions from subject experts

Go to the subject experts in institution and interact with them about the Mini Project topic. You can also meet many subject experts from various parts of India through social media and some discussion forums. This helps you in getting suggestions in different possible ways, through which you can get a clear idea on your Mini Project topic.

4. Planning

After getting a clear idea about the topic, prepare a rough plan about procurement of resources, experimentation, analysis, simulation, survey, fabrication etc. along with your teammates. Make a rough schedule, adapt to it and distribute the work among your teammates. This will keep your Mini Project on track and individuals will come to know about their part in the Mini Project rather than any individual (leader) taking full responsibilities.

5. Execution of plans

Make sure that the materials will be ready for the experimentation/fabrication by the scheduled time. Follow the schedule during experimentation/fabrication to get accurate and efficient results.

6. Presentation

Experimentation/Fabrication does not make a Mini Project successful; one should be able to present the results in proper way. So it should be prepared in such a way that, it reflects the exact objective of your Mini Project.

The mini project shall be evaluated in two stages, Intermediate review and End Semester Review. Below points are considered for evaluation:

Sr.No.	Title
1	Quality of the presentation
2	Quality of the report
3	The quantum of the work
4	Understanding of the subject selected
5	Deal with questions

Internal Continuous Assessment (ICA)-

Guidelines for Mini-Project content & Mark Distribution

1. A group of maximum 04 students be formed for Mini-Project work.

2. Work diary and reporting to guide as per prescribed contact hours.

3. The contents of work diary shall reflect the efforts taken by project group for

i. Searching suitable mini-project work

ii. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring out the mini-project area.

iii. Brief report of feasibility studies carried to implement the conclusion.

iv. Rough Sketches/ Design Calculations, etc.

4. The mini-project may be based on software/experimental/analysis/fabrication work.

5. It will be preferable if student will work on the area of mini project in line with their proposed final year project.

6. The group has to give a power point presentation in front of the faculty members / panel of department at the end of semester along with the spiral bound report (Limited to 20 Pages).