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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

MAHIRAVANI, TRIMBAK ROAD, TAL & DIST: NASHIK-422213, MAHARASHTRA,INDIA

## B. Tech Mechanical Engineering

## Semester – III

| Sr. No. | Course Type | Course Code | Course Name | Teaching Scheme (Hrs./Week) | | | | Examination Scheme | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | C | Formative Assessment CIA | | Summative Assessment ESE | | |
| | | | | | | | | Theory | Lab | Theory | Lab | |
| 1 | PC | 2312201 | Applied Thermodynamics | 3 | -- | -- | 3 | 50 | -- | 50 | -- | 100 |
| 2 | PC | 2312202 | Strength of Materials | 3 | -- | -- | 3 | 50 | -- | 50 | -- | 100 |
| 3 | PC | 2312203 | Manufacturing Processes | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 4 | PC | 2312204 | Strength of Materials Lab | -- | -- | 2 | 1 | -- | 25 | -- | 25[a] | 50 |
| 5 | PC | 2312205 | Applied Thermodynamics lab | -- | -- | 2 | 1 | -- | -- | -- | 25[a] | 25 |
| 6 | OE | 2312206 | Open Elective-I | 3 | -- | -- | 3 | 50 | -- | 50 | -- | 100 |
| 7 | IC (HSSM) | 2300201 | Principles of Managements | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 8 | IC (VEC) | 2300202 | Industrial Psychology | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 9 | IC (MD) | 2300203 | Multidisciplinary –Design Thinking | 1 | -- | 2 | 2 | -- | 25 | 25 | 25[a] | 75 |
| 10 | IC (CEP) | 2300204 | Community Engagement Project | -- | -- | 4 | 2 | -- | 25 | | 25[a] | 50 |
| 11 | SDC | 2312701 | IC Engine Maintenance | -- | -- | 2 | -- | -- | -- | -- | -- | -- |
| 12 | EEC | 2312801 | Welding Technology | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **TOTAL** | | | | **16** | **00** | **12** | **21** | **225** | **75** | 325 | **100** | **725** |
| **Open Elective I** | | | | | | | | | | | | |
| 7 | OE | 2312206A | Sustainable & Green Energy | 3 | -- | -- | 3 | 50 | -- | 50 | -- | 100 |
| 7 | OE | 2312206B | Production Processes | 3 | -- | -- | 3 | 50 | -- | 50 | -- | 100 |
| **Value Added Course** | | | | | | | | | | | | |
| 13 | VAC | VAC121 | Solid Modeling & Drafting | - | -- | 2 | 1 | -- | 25 | -- | -- | 25 |

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312201: Applied Thermodynamics**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 3 hrs/week** | **Th:03** | **Theory** | **CIA: 50** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To understand laws of thermodynamics.
2. To explain the application of thermodynamics.
3. To analyze Gas Power cycles and Vapour power cycles
4. To identify the sources of energy and their conversions
5. To undertake the performance analysis of a steam generator.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Identify notations and governing laws of thermodynamics.

**CO2:** Explain the concepts of entropy and apply the thermodynamics laws to formulate for closed systems and open systems.

**CO3:** Apply the first and second laws of thermodynamics to formulate and solve engineering problems for power cycles.

**CO4:** To understand Combustion in SI and CI engines and factors affecting performance parameters.

**CO5:** To estimate performance parameters by conducting a test on I. C. Engines.

**CO6:** To get conversant with steam generator and its performance calculations

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312201: Applied Thermodynamics**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Laws of thermodynamics** **(6 Hrs.)** | **CO** |
| Introduction of thermodynamics, Review of basic definitions, Thermodynamic properties and their units, Zeroth law of thermodynamics, First law of thermodynamics, Joules experiment, Applications of first law to flow and non flow processes and cycles. Steady flow energy equation and its application to different devices. Limitations of First law, Second Law of thermodynamics, Equivalence of Clausius and Kelvin Plank Statement, PMM I and II. | | **CO1** |
| **Unit 2** | **Entropy and Ideal Gas** **(8 Hrs.)** | **CO2** |
| Entropy as a property, Clausius inequality, Principle of increase of Entropy, Change of entropy for an ideal gas and pure substance.<br><br>Ideal Gas definition Gas Laws: Boyle's law, Charle's law, Avagadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas processes- on P-V and T-S diagrams Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic, Throttling Processes, Calculations of heat transfer, work done, internal energy. Change in entropy, enthalpy | | |
| **Unit 3** | **Gas Power cycles and Vapour Power Cycle** **(8 Hrs.)** | **CO3** |
| Air Standard Cycle, Efficiency and Mean Effective Pressure, Otto Cycle, Diesel cycle, Dual cycle, Comparison of cycles, Brayton cycle, Refrigeration Cycle<br><br>Carnot cycle, Rankine cycle, Comparison of Carnot cycle and Rankine cycle, Efficiency of Rankine cycle, Relative efficiency, Effect of superheat, boiler and condenser pressure on performance of Rankine cycle. | | |
| **Unit 4** | **SI and CI Engines** **(7 Hrs.)** | **CO4** |

| | | |
|---|---|---|
| IC and EC engines, I.C. Engine construction - components and materials, Engine Nomenclature, Valve timing diagram, Intake and exhaust system, Engine classification, Applications.<br><br>**SI Engines**: Theory of Carburetion and Types of Carburetor, Working of Simple Carburetor, Combustion stages in SI engines, Abnormal Combustion, Theory of Detonation and Parameters affecting detonations.<br><br>**CI Engines:** Fuel Injection system, Construction and Working of Fuel Pump, Fuel Injector and Combustion stages in CI engines, Theory of knocking and Parameters affecting knocking, | | |
| **Unit 5** | **Testing of IC Engines** **(7 Hrs.)** | **CO5** |
| Objective of testing, Various performance parameters for I.C. Engine - Indicated power, brake power, friction power, SFC, AF ratio etc. Methods to determine various performance parameters, characteristic curves, heat balance sheet. Supercharging and turbo-charging methods and their limitations. | | |
| **Unit 6** | **Steam Generators** **(6 Hrs.)** | **CO6** |
| Classification of steam generators, Constructional details of low pressure boilers, Features of high pressure (power) boilers, Introduction to IBR Act Boiler draught (natural and artificial draught) Boiler performance calculations-Equivalent evaporation, Boiler efficiency Energy balance. | | |

**Text Books**

1. Nag, P. K., “Engineering Thermodynamics," Tata McGraw-Hill Publisher Co. Ltd.
2. R. K. Rajput, Engineering Thermodynamics, EVSS Thermo Laxmi Publications.
3. V. Ganesan, “Internal Combustion Engines”, Tata McGraw-Hill

4. M. L. Mathur and R.P. Sharma, "A course in Internal combustion engines", Dhanpat Rai & Co.
5. H.N. Gupta, "Fundamentals of Internal Combustion Engines", PHI Learning Pvt. Ltd.

**Reference Books**

1. Y. Cengel & Boles: Thermodynamics – An Engineering Approach, Tata McGraw Hill Publications.
2. P. L Ballany: Thermal Engineering, Khanna Publishers.
3. C.P. Arora: Engineering Thermodynamics, Tata McGraw Hill Publications.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312202: Strength of Materials**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 3 hrs/week** | **Th:03** | **Theory** | **CIA: 50** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

The course enables the students with an understanding of fundamental concepts of stress, strain and the response of solid engineering materials to external loadings.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1: Explain** the concepts of stress & strain and **calculate** deformation under different loading conditions.

**CO2: Analyze** the principal stresses in elements and **calculate** strain energy based on loading condition.

**CO3: Construct** shear force & bending moment diagram for various loading conditions and **calculate** bending stresses in beams.

**CO4: Formulate** slope and deflection equations for beams subjected to various loads.

**CO5: Construct** shear stress distribution diagram and **analyze** torsional shear stresses in circular shafts.

**CO6: Analyze** stresses in cylinders and evaluate buckling in columns.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312202: Strength of Materials**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Simple Stresses & Strains** **(7 Hrs.)** | **CO** |
| Normal stress, Shear stress, Strain, Stress strain relation, Elastic limit, Hooke's law, Modulus of elasticity, Modulus of rigidity, Factor of safety, Bars of varying sections, Bars of composite sections, Thermal stresses, Longitudinal strain, Lateral strain, Poisson's ratio, Volumetric strain, Bulk modulus. | | **CO1** |
| **Unit 2** | **Principal Stresses and Concept of Strain Energy** **(7 Hrs.)** | **CO2** |
| Principal Stresses and Strains: Normal stress and shear stress on inclined plane, Principal planes and principal stresses, Maximum shear stress, Stresses on oblique section, Mohr's circle.<br>Strain Energy: Resilience, Proof resilience, Modulus of resilience, Static loads, Dynamic loads, Fluctuating loads, Strain energy in gradual, sudden and impact loading. | | |
| **Unit 3** | **Shear Force, Bending Moment and Bending Stresses in Beams** **(7 Hrs.)** | **CO3** |
| Shear Force and Bending Moment: Concept of shear force and bending moment, Types of beams, Types of load, Shear force and bending moment diagrams, Point of contra flexure.<br>Bending Stresses in Beams: Simple bending, Neutral axis and moment of resistance, Section modulus, Symmetrical sections, Unsymmetrical sections, Strength of a section, Composite beams.<br>*Analysis of beams for shear force and bending moment using CAD tools.* | | |
| **Unit 4** | **Deflection of Beams** **(6 Hrs.)** | **CO4** |
| Slope, deflection and radius of curvature, Relation between slope, deflection and radius of curvature, Derivation of differential equation of elastic curve, Double integration method, Macaulay's method, Castigliano's theorem. | | |
| **Unit 5** | **Shear Stresses in Beams and Torsion** **(8 Hrs.)** | **CO5** |
| Shear Stresses in Beams: Concept of shear stress, Shear stress distribution diagram for common symmetrical sections, Effect of shear stresses in beams, Maximum and average sheer stress, Shear connection between flange and web. | | |

| | | |
|---|---|---|
| Torsion: Theory of pure torsion, Torsional moment of resistance, Polar modulus, Power transmitted by shaft, Torsional rigidity, Stepped shafts, Composite shafts, Shafts with fixed ends, Shafts in series and parallel, Torque transmitted by solid and hollow shafts, Closed coil helical springs in series and parallel. | | |
| **Unit 6** | **Axially loaded columns and stresses in cylinder** **(7 Hrs.)** | **CO6** |
| Axially Loaded Columns: Axially loaded compression members, Crushing load, Buckling of column, Euler's column theory, Limitation of Euler's formula, Rankine's method, Expression of crippling load, Effective length of column.<br>Stresses in Cylinders: Circumferential and longitudinal stresses, Maximum shear stress, Deformation of cylinders, Compound cylinders. | | |

## Text Books

1. Strength of Materials, S. Ramamrutham and R. Narayanan, 18th Edition, 2018, Dhanapat Rai Publishing Company.
2. Strength of Materials, R. K. Bansal, 6th Edition, 2017, Laxmi Publications.

## Reference Books

1. Mechanics of Material, Ferdinand P Beer, E Russell Johnston, John T DeWolf, David F Mazurek, 7th Edition, 2015, Tata McGraw Hill.
2. Mechanics of Materials by R. C. Hibbeler, 10th edition, 2018, Pearson EducationY.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312203: Manufacturing Processes**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. Describe various sand and permanent mould casting methods, procedure and mould design aspects.
2. Understand basics of metal forming processes, equipment and tooling.
3. Understand sheet metal forming operations and die design procedure.
4. Classify, describe and configure the principles of various welding techniques.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Understand and select appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and design riser size and location for sand casting process

**CO2:** Understand mechanism of metal forming techniques and calculate load required for flat rolling

**CO3:** Classify and explain different welding processes and evaluate welding characteristics

**CO4:** Demonstrate press working operations and apply the basic principles to design dies and tools for forming and shearing operations

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312203: Manufacturing Processes**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Moulding and Casting Processes** **(7 Hrs.)** | **CO** |
| Introduction to casting processes, Patterns: Pattern materials, types of pattern, allowances pattern design, Moulding sand, Properties of moulding sands, Core making, Melting practices and furnaces, Pouring and Gating system design, Numerical estimation to find mold filling time, Riser design and placement, Principles of cooling and solidification of casting, Directional and Progressive solidification Estimation of solidification rate, Cleaning and Finishing of casting, Defects and remedies, Principle and equipments of Permanent mould casting, Investment casting, Centrifugal casting, Continuous casting | | **CO1** |
| **Unit 2** | **Bulk Metal Forming Processes** **(7 Hrs.)** | **CO2** |
| Plastic deformation. Stress-strain diagram for different types of material, Hot and Cold working, Factors affecting plastic deformation, Yield criteria, Concept of flow stress, Forming Limit diagram<br>**Rolling Process**: Rolling terminology, Friction in rolling, Calculation of rolling load<br>**Forging**: Open and closed die forging, Forging operations<br>**Extrusion**: Types, Process parameter<br>**Wire and Tube Drawing**: Wire and tube drawing process, Die profile<br>Friction and lubrication in metal forming, Forming defects, causes and remedies for all forming processes | | |
| **Unit 3** | **Metal Joining Processes** **(7 Hrs.)** | **CO3** |
| Types of metal joining processes, weldability, types of welding; arc welding: carbon arc, metal arc, metal inert gas, tungsten inert gas, plasma arc, submerged arc, electro-slag; gas welding; resistance welding: butt, spot, seam, projection; solid-state welding: friction, ultrasonic, explosive; thermit welding, advanced welding processes viz. laser welding and electron beam welding; brazing, soldering, adhesive bonding. | | |
| **Unit 4** | **Sheet Metal Forming** **(7 Hrs.)** | **CO4** |
| Types of sheet metal operations, Press working equipment and terminology, Types of dies, Clearance analysis, Estimation of cutting forces, Centre of pressure and blank size determination, | | |

| | |
|---|---|
| Design of strip lay-out, Blanking die design, Introduction to Drawing, Bending dies, Methods of reducing forces, Formability and forming limit diagrams | |

## Text Books

1. Manufacturing Technology (Volume I), P. N. Rao, 3rd edition, 2011, Tata McGraw Hill.
2. Workshop Technology (Volume I), Hajra Chaudhary, 16th Edition, 2009, Media Promoters & Publishers.
3. Workshop Technology (Volume I and II), B. S. Raghuwanshi, 10th Edition, 2009, Dhanpatrai and company.
4. Manufacturing Science, Ghosh & Malik, 1st Edition, 1986, East-West Press.
5. P. C. Sharma, "Production Engineering", Khanna Publishers.

## Reference Books

1. Manufacturing Engineering & Technology, Kalpakjian, 4th Edition, 2002, Pearson.
2. Workshop Practice, H. S. Bawa, 8th Edition, 2009, Tata Mc-Graw Hill.
3. Production Technology, R. K. Jain, 17th Edition, 1986, Khanna Publishers.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312204: Strength of Materials Lab**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: 01** | | **End-Sem:--** |
| **Prerequisite : Nil** | | **Pract:** | **25** |
| | | **Oral:** | **25** |
| | | **Termwork** | **--** |

## Course Objectives:

The course enables the students with an understanding of fundamental concepts of stress, strain and the response of solid engineering materials to external loadings.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Explain the concepts of stress & strain and calculate deformation under different loading conditions.

**CO2:** Analyze the principal stresses in elements and calculate strain energy based on loading condition.

**CO3:** Construct shear force & bending moment diagram for various loading conditions and calculate bending stresses in beams.

**CO4:** Formulate slope and deflection equations for beams subjected to various loads.

**CO5:** Construct shear stress distribution diagram and analyze torsional shear stresses in circular shafts.

**CO6:** Analyze stresses in cylinders and evaluate buckling in columns.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312204: Strength of Materials Lab**

| **Practical Work:-**<br>**The student shall complete the following activity as a practical work.** | | |
|---|---|---|
| Expt. No. 1 | Tension test for Ductile material using extensometer on Universal Testing Machine | **CO1** |
| Expt. No. 2 | Compression test for Brittle material on Universal Testing Machine. | **CO1** |
| Expt. No. 3 | Shear test of ductile material on Universal Testing Machine. | **CO2** |
| Expt. No. 4 | Tension test of Plastic/Composite material on low load capacity Tensile Testing Machine. | **CO2** |
| Expt. No. 5 | Experimental verification of flexural formula in bending for cantilever, Simple supported beam. | **CO3, CO4** |
| Expt. No. 6 | Experimental verification of torsion formula for circular bar. | **CO5** |
| Expt. No. 7 | Failure Mode Analysis and Stresses in structures with case study. (Self-learning) | **CO6** |
| Expt. No. 8 | Analysis of stresses in any one component from syllabus using software tool (Self-learning) | **CO1-CO6** |

## Text Books


1. Strength of Materials, S. Ramamrutham and R. Narayanan, 18th Edition, 2018, Dhanapat Rai Publishing Company.
2. Strength of Materials, R. K. Bansal, 6th Edition, 2017, Laxmi Publications.


## Reference Books


1. Mechanics of Material, Ferdinand P Beer, E Russell Johnston, John T DeWolf, David F Mazurek, 7th Edition, 2015, Tata McGraw Hill.
2. Mechanics of Materials by R. C. Hibbeler, 10th edition, 2018, Pearson EducationY.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312205: Applied Thermodynamics Lab**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: 01** | | **End-Sem:--** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **25** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To understand laws of thermodynamics.
2. To explain the application of thermodynamics.
3. To analyze Gas Power cycles and Vapour power cycles.
4. To identify the sources of energy and their conversions.
5. To undertake the performance analysis of a steam generator.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Identify notations and governing laws of thermodynamics.

**CO2:** Explain the concepts of entropy and apply the thermodynamics laws to formulate for closed systems and open systems.

**CO3:** Apply the first and second laws of thermodynamics to formulate and solve engineering problems for power cycles.

**CO4:** To understand Combustion in SI and CI engines and factors affecting performance parameters.

**CO5:** To estimate performance parameters by conducting a test on I. C. Engines.

**CO6:** To get conversant with steam generator and its performance calculations

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312205: Applied Thermodynamics Lab**

| **Practical Work:-**<br>**The student shall complete out of 6 experiment from Group-A and visit reports from Group-B is compulsory** | | |
|---|---|---|
| **Group -A** | | |
| Expt. No. 1 | Joule's experiment to validate first law of thermodynamics. | **CO1, CO2** |
| Expt. No. 2 | Study of Gas Turbine Model | **CO3** |
| Expt. No. 3 | Study of Steam Engine model. | **CO4** |
| Expt. No. 4 | Study and working of Two stroke Petrol and Diesel Engine. | **CO4** |
| Expt. No. 5 | Study and working of Four stroke Petrol and Diesel Engine. | **CO4** |
| Expt. No. 6 | Determination of Indicated H.P. of I.C. Engine by Morse Test. | **CO5** |
| Expt. No. 7 | To study low pressure boilers and their accessories and mountings. | **CO6** |
| Expt. No. 8 | To study high pressure boilers and their accessories and mountings. | **CO6** |
| **Group -B** | | |
| Visit | The Visit of Students to Thermal Power Plant is mandatory, to provide awareness and understanding of Course | **CO3CO4CO6** |
| Visit | The Visit of Students to Non-Convectional Power Plant is mandatory, to provide awareness and understanding of Course | **CO1CO3** |

**Text Books**


1. Nag, P. K., "Engineering Thermodynamics," Tata McGraw-Hill Publisher Co. Ltd.
2. R. K. Rajput, Engineering Thermodynamics, EVSS Thermo Laxmi Publications.
3. V. Ganesan, "Internal Combustion Engines", Tata McGraw-Hill

4. M. L. Mathur and R.P. Sharma, "A course in Internal combustion engines", Dhanpat Rai & Co.
5. H.N. Gupta, "Fundamentals of Internal Combustion Engines", PHI Learning Pvt. Ltd.

**Reference Books**

1. Y. Cengel & Boles: Thermodynamics – An Engineering Approach, Tata McGraw Hill Publications.
2. P. L Ballany: Thermal Engineering, Khanna Publishers.
3. C.P. Arora: Engineering Thermodynamics, Tata McGraw Hill Publications.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312206A: Sustainable & Green Energy**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 3 hrs/week** | **Th:03** | **Theory** | **CIA: 50** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To understand the scope of non-conventional energy resources.
2. To understand the solar energy application.
3. To understand the energy generation process though Geothermal Energy.
4. To understand the role of wind energy.
5. To identify different biomass and biogas energy generation.
6. To understand ocean energy in the energy generation

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** To Understand the Need, importance and scope of non-conventional and alternate energy resources.

**CO2:** Able to understand the solar energy operation and its characteristics

**CO3:** To understand the role of geothermal energy in the energy generation.

**CO4:** To educate the wind energy operation and its types.

**CO5:** Able to understand the biomass and biogas energy generation and its technologies.

**CO6:** To understand the role of ocean energy in the energy generation

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312206A: Sustainable & Green Energy**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Introduction of Sustainable & Green Energy** **(6 Hrs.)** | **CO** |
| **Introduction:** Causes of Energy Scarcity, Solution to Energy Scarcity, Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Factors Affecting Energy Resource Development, Renewable Energy in India. | | **CO1** |
| **Unit 2** | **Solar Thermal Energy** **(8 Hrs.)** | **CO2** |
| **Solar Thermal Energy:** Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.<br><br>**Solar Cells:** Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations. | | |
| **Unit 3** | **Geothermal Energy & Magneto-hydrodynamics (MHD)** **(7 Hrs.)** | **CO3** |
| **Geothermal Energy:** Resources of geothermal energy, thermodynamics of geo- thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.<br><br>**Magneto-hydrodynamics (MHD):** Principle of working of MHD Power plant, performance and limitations. Cells: Principle of working of various types of fuel cells and their working, performance and limitations. | | |
| **Unit 4** | **Wind Energy & Thermo-electrical and Thermionic Conversions (6 Hrs.)** | **CO4** |
| **Wind Energy:** Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. | | |

| | | |
|---|---|---|
| **Thermo-electrical and thermionic Conversions:** Principle of working, performance and limitations. | | |
| **Unit 5** | **Bio-mass & Biogas Energy** **(8 Hrs.)** | **CO5** |
| **Biomass Energy:** Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers<br>**Biogas Energy:** Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.. | | |
| **Unit 6** | **Tidal Energy & Ocean Thermal Energy Conversion** **(7 Hrs.)** | **CO6** |
| **Tidal Energy:** Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy.<br>**Ocean Thermal Energy Conversion (OTEC):** Availability, theory and working principle, performance and limitations | | |

**Text Books**

1. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
2. M.V.R. Koteswara Rao, “Energy Resources: Conventional & Non-Conventional” BSP Publications, 2006.
3. Raja et. al, “Introduction to Non-Conventional Energy Resources” Scitech Publications.

4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
7. Godfrey Boyle, "Renewable Energy Power for A Sustainable Future", Oxford University Press.

**Reference Books**

1. Khan, B. H., "Non-Conventional Energy Sources, Tata McGraw-Hill Publisher Co. Ltd.
2. Renewable Energy Sources: Twidell & Weir, CRC Press.
3. Solar Energy/ S.P. Sukhatme, Tata McGraw-Hill.
4. Non-Conventional Energy Systems: K M. Mittal, A H Wheeler Publishing Co Ltd.
5. Biomass Energy, Oxford &IBH Publication Co.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312206B: Production Processes**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 3 hrs/week** | **Th:03** | **Theory** | **CIA: 50** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To understand the basic concept of casting processes
2. To understand the basic concept of metal forming and its application
3. Classify, describe and configure the principles of various welding techniques.
4. To understand the conventional and nonconventional machining processes.
5. To know about the computer integrated manufacturing processes.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Illustrate and elaborate different casting processes.

**CO2:** Interpret different kinds of metal forming processes.

**CO3:** Elaborate the different types of welding processes as per applications.

**CO4:** Interpret about machining tools and machining mechanism

**CO5:** Elaborate the different kinds of non-traditional machining processes

**CO6:** Explain the computer integrated manufacturing processes

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312206B: Production Processes**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Casting** **(6 Hrs.)** | **CO** |
| Introduction to casting processes and applications, patterns – types and materials, allowances, molds and cores – materials, design of gating and riser, Casting defects. | | **CO1** |
| **Unit 2** | **Metal forming** **(7 Hrs.)** | |
| Introduction to hot and cold working – forging, rolling, extrusion and wire drawing, Introduction to sheet metal working processes – blanking, bending and deep drawing, Metal working defects. | | **CO2** |
| **Unit 3** | **Joining of materials** **(8 Hrs.)** | **CO3** |
| Introduction to fusion welding processes (metal arc, MIG, TIG, plasma arc, submerged arc welding processes), Different heat sources (flame, arc, resistive, laser, electron beam), Principles of solid state welding processes (friction, explosive welding, ultrasonic welding processes), Principles of adhesive, brazing and soldering processes, Origins of welding defects. | | |
| **Unit 4** | **Machine Tools and Machining** **(7 Hrs.)** | **CO4** |
| Basic machine tools like centre lathe, milling machine, and drilling machine, Machining processes - turning, drilling, boring, milling, grinding, Geometry of single point cutting tools, chip formation, cutting forces, Merchant's analysis, Tool materials and tool life, Cutting fluids. | | |
| **Unit 5** | **Non-traditional machining** **(7 Hrs.)** | **CO5** |
| Introduction to non-traditional machining processes – Ultrasonic machining, Abrasive jet machining, Water jet machining, Abrasive water jet machining, Electric discharge machining, Laser beam machining, Electron beam machining, Plasma and Electro chemical machining. | | |
| **Unit 6** | **Computer Integrated Manufacturing** **(7 Hrs.)** | **CO6** |
| Basic concepts of CAD and CAM, Automation in manufacturing, Cellular manufacturing and FMS – Group technology, CAPP. | | |

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312206B: Production Processes**

## Text Books


1. Production Technology by P.C. Sharma S Chand & Co Ltd.
2. Manufacturing Technology Vol. I & II, By P.N. Rao, Tata McGraw Hill.
3. Manufacturing Engineering and Technology by S. Kalpakjian, Pearson.
4. Production technology, by R.K. Jain, Khanna publishers.


## Reference Books


1. Degarmon's Materials and Processes in Manufacturing, 11th Ed. Black, Ronald A Kohser, Wiley India
2. Manufacturing Processes and Systems, 9th Ed. Phillip F., Ostwald, Jairo Munoz, Wiley India
3. Welding Technology, by O. P. Khanna, Dhanpat Rai publishers.

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common)** ***(2023 Pattern)***

Sem-III

2300201: Principles of Management

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| | | | **End-Sem:50** |
| | | **Pract:** | **--** |
| | | **Oral:** | -- |
| | | **Termwork** | **--** |

**Course Objectives: The student should be able to**

1. Comprehend the nature and characteristics of management, its scope, and various functional areas.
2. Recognize the importance of ethical values in managerial decision-making and actions.
3. Explore the concepts of authority, delegation, decentralization, and their impact on organizational structure.
4. Analyze the techniques of coordination in managing complex organizational tasks.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Inculcate The Ability To Apply Multifunctional Approach To Organizational Objective.

**CO2:** Apply Process Based Thinking And Risk Based Thinking For Managing And Improving The Functioning Of An Organization

**CO3:** Examine The Inter-Relationships Between The Planning And Organising, Directing And Communicating, Controlling And Coordinating Etc.

**CO4:** Develop Skills For Corrective Action Management And Continual Improvement Project Management.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S. Y. B. Tech (Common)** ***(2023 Pattern)***

Semester: III

2300201: Principles of Management

| **Unit 1:Introduction to Management** **7hrs** | **CO** |
|---|---|
| Definition and scope of management, Evolution of management theories, Functions of management: planning, organizing, leading, and controlling, Managerial roles and skills, Challenges and opportunities in contemporary management, Management As A Science, Art Or Profession; Management And Administration; Difference Between management And Administration. Significance Of Values And Ethics In Management | CO1 |
| **Unit 2: Planning, Organizing and Decision Making** **7hrs** | CO2 |
| Nature, Scope, Objective And Significance Of Planning, Elements And Steps Of Planning, Decision Making Organizing Principles, Span Of Control, Line And Staff Relationship, Authority, Delegation And Decentralization. Effective Organizing, Organizational Structures, Formal And Informal Organizations, Staffing, Importance of planning in achieving organizational goals, Types of plans: strategic, tactical, operational, Process of decision making, Decision-making models and techniques, Setting objectives and formulating strategies | |
| **Unit 3:Organizing and Organizational Structure, Leading and Managing Human Resources** **7hrs** | CO3 |
| Principles of organizing, Types of organizational structures, Departmentalization and delegation of authority, Coordination and integration of activities, Formal and informal organization, The role of leadership in management, Leadership styles and their impact on organizational culture, Recruitment,Selection,Placement,Promotion,Separation,Performance Appraisal,Meaning And Nature Of Direction, Motivation theories and their application in the workplace, Communication and its importance in effective leadership, Managing diversity and fostering inclusivity. | |
| **Unit 4: Communicating, Controlling And Coordinating** **7hrs** | CO4 |
| Communication - Meaning And Importance, Communication Process, Barriers To Communication, Steps To Overcome Communication Barriers, Types Of Communication; Motivation Theories – Maslow's Need Hierarchy Theory, Herzberg's Two Factor Theory. **Leadership** – Meaning, Formal And Informal Leadership, Characteristics Of Leadership; Leadership Styles – Autocratic Style, Democratic Style, Participative Style, Laissez Faire Leadership Styles, Transition Leadership, Charismatic Leadership Style, Elements Of Managerial Control, Control Systems, Management Control Techniques, Effective Control Systems. Coordination Concept, Importance, Principles And Techniques Of Coordination, Concept Of Managerial Effectiveness. | |

**Text Books**


1. Principles of Management" by P. C. Tripathi and P. N. Reddy
2. Fundamentals of Management" by R. S. Dwivedi
3. "Management: Theory and Practice" by Kris Cole
4. "Principles of Management" by V. S. Ramaswamy and S. Namakumari
5. Essentials of Management" by Harold Koontz and Heinz Weihrich (Indian adaptation by A. Aryasri)

**Reference Books**

1. Management: Tasks, Responsibilities, Practices" by Peter F. Drucker
2. The Practice of Management" by Peter F. Drucker
3. "Management: Text and Cases" by V. S. P. Rao
4. Management: Concepts and Practices" by Tim Hannagan
5. Management: Principles and Practice" by S. K. Chakraborty and D. Chatterjee
6. Modern Management: Concepts and Skills" by Samuel C. Certo and S. Trevis Certo
7. Management: A Global and Entrepreneurial Perspective" by Heinz Weihrich, Mark Cannice, and Harold Koontz

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S. Y. B. Tech (Common) *(2023 Pattern)***

Sem - III

2300202:Industrial Psychology

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| | | | **End-Sem:50** |
| | | **Pract:** | **--** |
| | | **Oral:** | -- |
| | | **Termwork** | **--** |

**Course Objectives: The student should be able to**

1. Develop an awareness of the major perspectives underlying the field of Industrial Psychology.
2. Apply the principles of human psychology to the corporate field and familiarize them with the current practices in the corporate. .
3. Develop an understanding of group dynamics, norms, and cohesiveness, enabling them to build and lead effective teams within the organization.
4. Familiarize with the field of occupational psychology and its applications in selection, placement, counseling, and training of employees.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Learn about theories of motivation and group behavior.

**CO2:** Understanding of key concepts, theoretical perspectives, and trends in industrial psychology.

**CO3:** Analyze and interpret the role of motivation & Morale in behavior modification.

**CO4:** Analyze the impact of human engineering and physical environment on job performance and employee well-being**.**

**CO5:** Apply psychological principles in addressing work-related challenges...

**CO6:** Design the role of psychologists in industrial settings and appreciate their impact on employee well-being and organizational performance**.**

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S. Y. B. Tech (Common) *(2023 Pattern)***

Sem - III

2300202:Industrial Psychology

| **Unit 1:Introduction** **6hrs** | **CO** |
|---|---|
| The role of the psychologist in industry, the field of occupational Psychology: Study of behavior in work situation and applications of Psychological principles to problems of selection, Placement, Counseling and training | CO1 |
| **Unit 2: Design of Work Environments** **7hrs** | |
| Human engineering and physical environment techniques of job analysis, Social environment: Group dynamics in Industry Personal psychology, Selection, training, placement, promotion, counseling, job motivations, job satisfaction. Special study of problem of fatigue, boredom and accidents | CO2 |
| **Unit 3: Individual and Group Behavior** **7 hrs** | |
| Introduction, Objectives, Individual Behavior, Individual Differences: Meaning, Nature, Dimensions and Values, Factors Influencing Individual Behavior, Group Behavior: Introduction, Objectives, Meaning, Definition and Advantages of Groups, Types of Groups, Group Dynamics, Group Norms Group Cohesiveness | CO3, CO4 |
| **Unit 4: Morale, Motivation& Counseling** **8hrs** | |
| Morale: Meaning, Types and Aspects, Characteristics of High and Low Morale and Essential and Psychological Requirements for High Morale, Introduction, Objectives, Meaning, Importance and Types of Motivation in Industry, Monetary and Non-Monetary Incentives, Fatigue, Boredom and Monotony: Meaning, Causes and Remedies, Introduction, Objectives, Counseling: Meaning, Significance, Types and Process, Employee Health, Safety and Security, Industrial Accidents: Accident Proneness and Prevention | CO5, CO6 |

**Text Books**


1. Tiffin, J and Mc Cormic E.J., Industrial Psychology, Prentice Hall, 6th Edn., 1975.
2. Mc Cormic E.J., Human Factors Engineering and Design, McGraw Hill, 4th Edn.,1976.
3. Mair, N.R.F., Principles of Human relations
4. Gilmer, Industrial Psychology
5. Ghiselli & Brown, Personnel and Industrial Psychology.
6. Myer, Industrial Psychology.
7. Dunnete, M.D., Handbook of Industrial and Organizational Psychology.
8. Blum & Taylor, Industrial Psychology


**Reference books**


1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.
2. Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBSPublication.
3. Aamodt, M.G. (2007) Industrial/Organizational Psychology : An Applied Approach
4. (5 th edition) Wadsworth/Thompson : Belmont, C.A.Blum M.L. Naylor J.C., Horper& Row, IndustrialPsychology, CBS Publisher, 1968
5. Luthans, Organizational Behaviour, McGraw Hill, International, 1997
6. Morgan C.t.,KingR.A.,JohnRweisz & JohnSchoples, Introduction to Psychology, McHraw Hill, 1966
7. Schermerhorn J.R.Jr., Hunt J.G &Osborn R.N., Managing, Organizational Behaviour, John Willy

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common)** ***(2023 Pattern)***

Sem-IV

2300203: Design Thinking

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 1hrs/week** | **Th:01** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: 01** | | **ESE:25** |
| **Prerequisite :** | | **Pract:** | **--** |
| | | **Oral:** | **25** |
| | | **Termwork** | **25** |

**Course Objectives:**

**The student should be able to**

1. Learn design thinking concepts and principles
2. Use design thinking methods in every stage of the problem
3. Learn the different phases of design thinking
4. Apply various methods in design thinking to different problems

**Course Outcomes:**

**On completion of the course, learner will be able to**

**CO1**. Define key concepts of design thinking

**CO2**. Practice design thinking in all stages of problem solving

**CO3**. Apply design thinking approach to real world problems

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common)** ***(2023 Pattern)***

Sem-IV

**2300203:Design Thinking**

| **Unit 1 Introduction, Understand, Observe and Define The Problem7hrs** | **CO** |
|---|---|
| Why Design? - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.<br>Search field determination - Problem clarification - Understanding of the problem - Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs | CO1<br>CO2<br>CO3 |
| **Unit 2 Ideation, Prototyping, Testing and Implementation 7hrs** | |
| Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.<br>Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking | CO1<br>CO2<br>CO3 |

**TEXT BOOKS :**


1. Christian Mueller-Roterberg, Handbook of Design Thinking - Tips &Tools for how to design thinking.
2. Designing for Growth: a design thinking tool kit for managers By Jeanne Liedtka and Tim Ogilvie.
3. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown.


**REFERENCES:**


1. Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
3. HassoPlattner, ChristophMeinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
4. http://ajjuliani.com/design-thinking-activities/
5. https://venturewell.org/class-exercises


**LIST OF EXPERIMENTS:**

1. Case study on understanding of the design thinking problems.
2. Case study on observations of the parameters of design thinking problems.
3. Case study on defining design thinking problems.
4. Case study on description of customer needs of the parameters of design thinking problems.
5. Case study of ideation phase of solving design thinking problems
6. Case study of prototyping phase of solving design thinking problems
7. Case study of testing phase of solving design thinking problems
8. Case study of implementation phase of solving design thinking problems

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common) *(2023 Pattern)***

Sem-III

**2300204 : Community Engagement Project**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| Theory: -- | **Pr:02** | **Theory** | **CIA: --** |
| Practical: 4 hrs/week | | | **End-Sem:--** |
| | | **Pract:** | -- |
| | | **Oral:** | 25 |
| | | **Termwork** | 25 |

**Course Objectives: The student should be able to**

1. sensitize the students to the living conditions of the people in the surroundings.
2. bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability.
3. make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
4. make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
5. help students to initiate developmental activities in the community in coordination with public and government authorities.
6. develop a holistic life perspective among the students by making them to study culture, traditions, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Survey for the development of the community.
**CO2:** Interpret the social issues that confront the vulnerable / marginalized sections of the society.
**CO3:** Build team for societal change.
**CO4:** Create an opportunity to familiarize themselves with urban / rural community they live in.
**CO5:** plan activities based on the focused groups.
**CO6:** implement the ways of transforming the society through systematic programmeimplementation.

**PROCEDURE**

Students in a group (Maximum 5) can take up a planned community work for minimum of 50 hours. Evaluation of student's work will be based on the planning, execution and documentation of work, and a viva-voce by Departmental panel.

A group of students could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.

The Community Service Project is a twofold one

i. First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. For ex., a student of Arts will focus on socio-economic conditions, social survey and about the Government's social security schemes. This should not be viewed as a duplication of work by the Village or Ward volunteers; rather, it could be another primary source of data.
ii. Secondly, the student/s could take up a project work related to following domains.

a. Agriculture
b. Health
c. Marketing and Cooperation
d. Animal Husbandry
e. Horticulture
f. Fisheries
g. Sericulture
h. Revenue and Survey
i. Natural Disaster Management
j. Irrigation
k. Law & Order
l. Excise and Prohibition
m. Mines and Geology
n. Energy

The assessment is to be conducted for 50 marks. The number of credits assigned is 2. Later as per the present practice the marks are converted into grades and grade points to include finally in the SGPA and CGPA.

The weightings shall be:

| | |
|---|---|
| Project Report | 50% |
| Presentation | 50% |

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312701: IC Engine Maintenance**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: --** | | **End-Sem:--** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To make student familiar with IC Engine testing and maintenance procedure.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Understand and apply engine testing procedure and measure corresponding parameters.

**CO2:** Prepare heat balance sheet and can plot performance characteristics curve.

**CO3:** Carry out maintenance of engines in real life scenario.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312701: IC Engine Maintenance**

| **Topics for Teaching & Training** |
|---|
| 1. Disassembly and Assembly of engines |
| 2. Study of advanced diesel and gasoline engine technology engines |
| 3. Study and drawing of engine components with dimensions. |
| 4. Engine Testing Procedure, Measurement of indicated power, Brake power, fuel consumption, Air Consumption |
| 5. Heat balance sheet of IC Engines and performance characteristic curves. |
| 6. Visit to any workshop and study on practical engine maintenance procedures |
| **Evaluation** |
| Student shall submit a report on his interpretation of all the topics covered as a part of classroom teaching and actual field visit. |

**Reference Books**


1. Internal Combustion Engine Handbook (2016), Tech Trans by SAE International.
2. Internal Combustion Engines (2022), Giancarlo Ferrari, Angelo Onorati, Gianluca D'Errico by Società Editrice Esculapio.
3. Internal Combustion Engines Performance, Fuel Economy and Emissions (2014), Institution of Mechanical Engineers by Elsevier Science.
4. Fundamentals of Internal Combustion Engines (2006), H N Gupta by Prentice Hall of India Pvt. Ltd.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312801: Welding Technology**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: --** | | **End-Sem:--** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. Student will be able to relate with welding technologies available in the market for different materials.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Explain the basics of welded joints and different welding technologies.

**CO2:** Understand the process limitation of different welding methods

**CO3:** Select the most optimum welding technology based on materials and application

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**2312801: Welding Technology**

| Modules | Topics covered | CO |
|---|---|---|
| **1** | Basics of welding joints, weld zone, flux, types of welding processes, weldability, welding defects and limitations. **(3 Hrs.)** | **CO1** |
| **2** | Arc welding: carbon arc, metal arc, metal inert gas, tungsten inert gas, plasma arc, submerged arc, electro-slag; gas welding; resistance welding: butt, spot, seam, projection. **(4 Hrs.)** | **CO1, CO2** |
| **3** | Solid-state welding: friction, ultrasonic, explosive; thermit welding, advanced welding processes viz. laser welding and electron beam welding; brazing, soldering, adhesive bonding. **(4 Hrs.)** | **CO1, CO2** |
| **4** | Case study on industrial applications for welding of different materials **(4 Hrs.)** | **CO3** |
| **Expectations:** Students shall submit a report based on the above modules for the assessment of this course. | | |

## Text Books


1. Advanced Welding Technologies by K.S. Yadav, S. Chand Publication.
2. Welding Technology by O. P. Khanna, Dhanpat Rai Publishers.


## Reference Books


1. Welding & Welding Technology by Richard Little, MC Graw Hill Education.
2. Welding Technology by GD Garg, S.K. Kataria & Sons

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**VAC121: Solid Modeling & Drafting**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: 01** | | **End-Sem:--** |
| **Prerequisite : Nil** | | **Pract:** | **25** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To understand basic structure of CAD systems and their use to create geometric models of simple engineering parts.
2. To introduce the curves and surfaces and their implement in geometric modeling.
3. To apply basic concepts of 3D modeling, viewing and evaluate mass properties of components and assemblies.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Understand basic concepts of CAD system, need and scope in Product Lifecycle Management

**CO2:** Utilize knowledge of curves and surfacing features and methods to Create complex solid geometry

**CO3:** Construct solid models, assemblies using various modeling techniques & Perform mass property analysis, including creating and using a coordinate system

**CO4:** Understand different CAD programming languages.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-III

**VAC121: Solid Modeling & Drafting**

| **Practical Work:-**<br>**The student shall complete the following activity as a practical work using suitable CAD software.** | | |
|---|---|---|
| Expt. No. 1 | Study on basics of CAD. | **CO1** |
| Expt. No. 2 | 2-D sketching with geometrical and dimensional constraints | **CO2** |
| Expt. No. 3 | Solid & Surface modeling for simple mechanical components (Output file as Production drawing and Model Based Definition (MBD) (a) Sheet-Metal (b) Machining (c) Fabrication (d) Casting (e) Forgings (f) Plastic Molding | **CO2** |
| Expt. No. 4 | Assembly modeling (Output file as Assembly drawing and detailing) of the parts modeled in Practical assignment-2 using proper assembly constraint conditions and generation of exploded view for assemblies like Couplings, Clutches, Gear Assemblies, Engine/Pump/Turbine Components, Valves, Machine Tools, Automobile Components, Gear-Box, Pressure Vessels, etc. (One Component) | **CO3** |
| Expt. No. 5 | Assembly modeling as mentioned in experiment 3 (Another Component) | **CO3** |
| Expt. No. 6 | Reverse Engineering of surface/solid modeling using Point Cloud Data. | **CO3** |
| Expt. No. 7 | Assembly Modeling by importing parts/components from free online resources like CAD and Product development software websites, forums, blogs, etc. | **CO3** |
| Expt. No. 8 | Demonstration on CAD Customization (with introduction to programming languages, interfacing) | **CO4** |

**Text Books**


1. Zeid, I and Sivasubramania, R., (2009), “CAD/CAM : Theory and Practice”, 2nd edition, McGraw Hill Education, ISBN-13: 978-0070151345
2. Rao, P. N., (2017), “CAD/CAM: Principles and Applications”, 3rd edition, McGraw Hill Education, ISBN-13: 978-0070681934.

3. Chang, Kuang-Hua, (2015), "e-Design: Computer-Aided Engineering Design", Academic Press, ISBN-13: 978-0123820389

**Reference Books**

1. Lee, Kunwoo, (1999), "Principles of CAD/CAM/CAE Systems", Pearson/Addison-Wesley, ISBN-13: 978-0201380361
2. Bordegoni, Monica and Rizzi, Caterina, (2011), "Innovation in Product Design: From CAD to Virtual Prototyping", Springer, ISBN-13: 978-1447161875
3. Vukašinovic, Nikola and Duhovnik, Jože, (2019), "Advanced CAD Modeling: Explicit, Parametric, Free-Form CAD and Re-engineering", Springer, ISBN-13: 978-3030023980
4. Um, Dugan, (2018), "Solid Modeling and Applications: Rapid Prototyping, CAD and CAE Theory", 2nd edition, Springer, ISBN-13: 978-3319745930
5. Rogers, D. and Adams, J. A., (2017), “Mathematical Elements for Computer Graphics”, 2nd edition, McGraw Hill Education, ISBN-13: 978-0070486775
6. Hearn, D. D. and Baker, M. P., (2013), "Computer Graphics with OpenGL", 4th edition, Pearson Education India, ISBN-13: 978-9332518711
7. Gokhale, N. S., Deshpande, S. S., Bedekar, S. V. and Thite, A. N., (2008), “Practical Finite Element Analysis”, Finite to Infinite, Pune, India, ISBN-13: 978-8190619509
8. Lee Ambrosius, (2015), “AutoCAD® Platform Customization: User Interface, AutoLISP® , VBA, and Beyond”, John Wiley & Sons, Inc., IN, ISBN-13: 978-1118798904

SANDIP FOUNDATION

**SANDIP FOUNDATION'S**

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

MAHIRAVANI, TRIMBAK ROAD, TAL & DIST: NASHIK-422213, MAHARASHTRA,INDIA

## B. Tech Mechanical Engineering

## Semester – IV

| Sr. No. | Course Type | Course Code | Course Name | Teaching Scheme (Hrs./Week) | | | | Examination Scheme | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Formative Assessment CIA | | Summative Assessment ESE | | |
| | | | | L | T | P | C | Theory | Lab | Theory | Lab | |
| 1 | PC | 2312207 | Kinematics of Machinery | 3 | -- | -- | 3 | 50 | -- | 50 | -- | 100 |
| 2 | PC | 2312208 | Fluid Mechanics | 3 | -- | -- | 3 | 50 | -- | 50 | -- | 100 |
| 3 | PC | 2312209 | Engineering Materials and Metallurgy | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 4 | PC (MD) | 2312210 | Mechatronics | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 5 | PC | 2312211 | Kinematics of Machinery Lab | -- | -- | 2 | 1 | -- | -- | -- | 25[a] | 25 |
| 6 | PC | 2312212 | Fluid Mechanics Lab | -- | -- | 2 | 1 | -- | -- | -- | 25[a] | 25 |
| 7 | OE | 2312213 | Open Elective-II | 2 | | | 2 | 25 | -- | 50 | -- | 75 |
| 8 | IE (VEC) | 2300205 | First Level Course inForeign Language | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 9 | IC (HSSM) | 2300206 | Industrial Economics | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 10 | SDC (VSEC) | 2312702 | Refrigeration System Maintenance | -- | -- | 2 | 1 | -- | 25 | -- | -- | 25 |
| 11 | EEC | 2312802 | Preventive Maintainance in Bearings | -- | --- | -- | -- | --- | -- | -- | -- | -- |
| 12 | IC (AEC) | 2300207 | Industrial Work Study | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| **TOTAL** | | | | **18** | **00** | **06** | **21** | **250** | **25** | **400** | **50** | **725** |
| **First Level Course in Foreign Language (Any One)** | | | | | | | | | | | | |
| 8 | IE (VEC) | 2300205A | German Language | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 8 | IE (VEC) | 2300205B | French Language | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| **Open Elective II** | | | | | | | | | | | | |
| 7 | OE | 2312213A | Robotics | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| 7 | OE | 2312213B | Automation in Manufacturing | 2 | -- | -- | 2 | 25 | -- | 50 | -- | 75 |
| **Value Added Course** | | | | | | | | | | | | |
| 13 | VAC (VSEC) | VAC122 | Geometric Dimensioning &Tolerancing (GD&T) | -- | -- | 2 | 1 | -- | 25 | -- | -- | 25 |
| **Course Work (for Exit Criterion to UG Diploma)** | | | | | | | | | | | | |
| **Minor Project** | | | | -- | -- | -- | 2 | -- | 50 | -- | -- | 50 |
| **Internship (2 Weeks)** | | | | -- | -- | -- | 2 | -- | 50 | -- | -- | 50 |

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312207: Kinematics of Machinery**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 3 hrs/week** | **Th:03** | **Theory** | **CIA: 50** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.
2. To develop the competency to analyze the velocity and acceleration in mechanisms using analytical Method
3. To develop the competency to analyze the velocity and acceleration in mechanisms using graphical approach.
4. To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.
5. To develop the competency to understand & apply the principles of gear theory to design various applications.
6. To develop the competency to design a cam profile for various follower motions.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Apply kinematic analysis to simple mechanisms

**CO2:** Analyze velocity and acceleration in mechanisms by vector and graphical method

**CO3:** Synthesize a four bar mechanism with analytical Method

**CO4:** Synthesize a four bar mechanism with graphical methods

**CO5:** Apply fundamentals of gear theory as a prerequisite for gear design

**CO6:** Construct cam profile for given follower motion

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312207: Kinematics of Machinery**

| Units | | |
|---|---|---|
| **Unit 1** | **Fundamentals of Mechanism** **(7 Hrs.)** | **CO** |
| Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom, Mobility of Mechanism, Inversion, Grashoff's law, Four-Bar Chain and its Inversions, Slider crank Chain and its Inversions, Double slider crank Chain and its Conversions, Mechanisms with Higher pairs, Equivalent Linkages and its Cases - Sliding Pairs in Place of Turning Pairs, Spring in Place of Turning Pairs, Cam Pair in Place of Turning Pairs | | **CO1** |
| **Unit 2** | **Kinematic Analysis of Mechanisms: Analytical Method** **(7 Hrs.)** | **CO2** |
| Analytical methods for displacement, velocity and acceleration analysis of slider crank Mechanism, Velocity and acceleration analysis of Four-Bar and Slider crank mechanisms using Vector and Complex Algebra Methods. Computer-aided Kinematic Analysis of Mechanism like Slider crank and Four-Bar mechanism, Analysis of Single and Double Hook's joint | | |
| **Unit 3** | **Kinematic Analysis of Mechanisms: Graphical Method** **(7 Hrs.)** | **CO3** |
| Displacement, velocity and acceleration analysis mechanisms by Relative Velocity Method (Mechanisms up to 6 Links), Instantaneous Centre of Velocity, Kennedy's Theorem, Angular Velocity ratio Theorem, Analysis of mechanism by ICR method (Mechanisms up to 6 Links), Coriolis component of Acceleration (Theoretical treatment only) | | |
| **Unit 4** | **Synthesis of Mechanisms** **(7 Hrs.)** | **CO4** |
| **Steps in Synthesis**: Type synthesis, Number Synthesis, Dimensional synthesis, Tasks of Kinematic synthesis - Path, function and motion generation (Body guidance), Precision Positions, Chebychev spacing, Mechanical and structural errors<br>**Graphical Synthesis**: Inversion and relative pole method for three position synthesis of Four-Bar and Single Slider Crank Mechanisms<br>**Analytical Synthesis**: Three position synthesis of Four-Bar mechanism using Freudenstein's equation | | |
| **Unit 5** | **Kinematics of Gear** **(7 Hrs.)** | **CO5** |
| **Gear**: Classifications | | |

| | | |
|---|---|---|
| **Spur Gear**: Terminology, law of gearing, Involute and cycloidal tooth profile, path of contact, arc of contact, sliding velocity, Interference and undercutting, Minimum number of teeth to avoid interference, Force Analysis (theoretical treatment only)<br>**Helical and Spiral Gears** (theoretical treatment only): Terminology, Geometrical Relationships, virtual number of teeth for helical gears<br>**Bevel Gear & Worm and Worm Wheel** (theoretical treatment only): Terminology, Geometrical Relationships<br>**Gear Train:** Types, Analysis of Epicyclic gear Trains, Holding torque - simple, compound and Epicyclic gear Trains, Torque on Sun and Planetary gear Train, compound Epicyclic gear Train | | |
| **Unit 6** | **CAM and Follower** | **(7 Hrs.)** |
| **Cams & Followers**: Introduction, Classification of Followers and Cams, Terminology of Cam Displacement diagram for the Motion of follower as Uniform velocity, Simple Harmonic Motion (SHM), Uniform Acceleration and Retardation Motion (UARM), Cycloid motion, Cam Profile construction for Knife-edge Follower and Roller Follower, Cam jump Phenomenon | | **CO6** |

## Text Books

1. S. S. Rattan, “Theory of Machines”, Third Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Bevan T, “Theory of Machines”, Third Edition, Longman Publication
3. G. Ambekar, “Mechanism and Machine Theory”, PHI
4. J. J. Uicker, G. R. Pennock, J. E. Shigley, “Theory of Machines and Mechanisms”, Fifth Edition, International Student Edition, Oxford.

## Reference Books

1. Paul E. Sandin, “Robot Mechanisms and Mechanical Devices Illustrated”, Tata McGraw Hill Publication
2. Stephen J. Derby, “Design of Automatic Machinery”, 2005, Marcel Dekker, New York

3. Neil Sclater, “Mechanisms and Mechanical Devices Sourcebook”, Fifth Edition, Tata McGraw Hill Publication
4. Ghosh Malik, “Theory of Mechanism and Machines”, East-West Pvt. Ltd.
5. Hannah and Stephans, “Mechanics of Machines”, Edward Arnolde Publication
6. R. L. Norton, “Kinematics and Dynamics of Machinery”, First Edition, McGraw Hill Education (India) P Ltd. New Delhi
7. Sadhu Singh, “Theory of Machines”, Pearson
8. Dr. V. P. Singh, “Theory of Machine”, Dhanpatrai and Sons
9. C. S. Sharma & Kamlesh Purohit, “Theory of Machine and Mechanism”, PHI.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312208: Fluid Mechanics**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 3 hrs/week** | **Th:03** | **Theory** | **CIA: 50** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

**Course Objectives:**

1. Identify various properties of fluids and its use units.
2. State and illustrate the basics Fluid Statics
3. To identify various types of flows
4. Applications of Bernoulli's Equation for various applications
5. To identify the sources of energy and their conversions
6. Identify and explain the fluid properties and concepts of Boundary layer, Drag, Lift.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Able to explain the effect of fluid properties on a flow system.

**CO2:** calculate the hydrostatic pressure and force on plane and curved surfaces

**CO3:** Able to identify type of fluid flow patterns and describe continuity equation

**CO4:** identify how to derive basic equations and know the related assumptions.

**CO5:** apply the equation of the conservation of energy.

**CO6:** apply the similitude concept and set up the relation between a model and a prototype

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312208: Fluid Mechanics**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Properties of Fluid** **(7 Hrs.)** | **CO** |
| Definition of fluid, density, specific weight, specific gravity, viscosity, viscosity laws, types of fluid and measurement of viscosity, application based numerical on viscosity-flow through pipe, lubrication, parallel plates, rotating shafts etc., vapor pressure surface tension, capillarity, compressibility | | **CO1** |
| **Unit 2** | **Fluid Statics** **(7 Hrs.)** | **CO2** |
| **Laws of fluid statics**: forces acting on fluid element, Pascal's law, hydrostatics law, Pressure measurement:, piezometer, barometer, manometer - simple, inclined, differential, micro manometer, inverted manometer ,<br>**Forces acting on surfaces immersed in fluid:** total pressure and center of pressure on submerged plane surfaces, curved surface submerged in liquid including numerical on dam gate, metacenter and Metacentric height.<br>**Buoyancy:** flotation, stability of bodies | | |
| **Unit 3** | **Fluid Kinematics** **(7 Hrs.)** | **CO3** |
| **Fluid Kinematics:-** Flow description methods, types of flows, velocity and acceleration fields, continuity equation in Cartesians coordinates in 1D & 3D flow, flow visualization (path line, stream line and streak line), stream tube, angularity, vorticity, stream function and velocity potential function, flow net | | |
| **Unit 4** | **Fluid Dynamics** **(7 Hrs.)** | **CO4** |
| **Fluid Dynamics:-** Euler's equation of motion differential form and Navier Stokes equation, Euler's equation of motion along streamline, Bernoulli's theorem and modified Bernoulli's theorem, stagnation pressure, Flow measurement: venturimeter, orifice meter, pitot tubes, static pitot tube, orifices, notches<br>Laminar and Turbulent flow physics, entrance region and fully developed flow. Velocity and shear Stress distribution for laminar flow in a pipe, fixed parallel plates and Couette flow, hydro dynamically smooth and rough boundaries, Velocity profile of Turbulent flow. | | |

| | | |
|---|---|---|
| **Unit 5** | **Internal flows** **(7 Hrs.)** | **CO5** |
| **Flow through Pipes:** Laws of fluid friction for Laminar and Turbulent flow: Darcy's equation for Major/frictional losses, Minor losses in pipe fittings and valves, Hydraulic gradient line and total energy line(HGL, TEL), Pipes in series, Pipes in parallel and concept of Equivalent Pipe, Siphons, Transmission of Power (no derivations for minor losses, simple Numerical ). | | |
| **Unit 6** | **External flows** **(7 Hrs.)** | **CO6** |
| **Boundary layer theory**: - Boundary layer formation for flow over Flat plate, boundary layer thickness:-displacement, momentum and energy, Separation of Boundary Layer and Methods of Controlling.<br>**Forces on immersed bodies:** -Lift and Drag, flow around cylinder and aerofoil (Pressure distribution and Circulation).<br>**Dimensional Analysis:** Dimensions of Physical Quantities, dimensional homogeneity, Buckingham π Theorem, important dimensionless numbers, Model analysis, Reynolds, Froude and Mach). | | |

## Text Books

1. Sukumar Pati, "Fluid Mechanics and Hydraulics Machines", TATA McGraw Hill.
2. Modi P. N. and Seth S. M, "Hydraulics and Fluid Mechanics",Standard Book House.
3. Cengel & Cimbla, "Fluid Mechanics",TATA McGraw-Hill.
4. F. M. White, "Fluid Mechanics", TATA McGraw-Hill.
5. R. K. Bansal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publication.
6. Theory of hydraulic Machinery, V. P. Vasandani.
7. Hydraulic Machines, J. Lal, Metropolitan Book.

## Reference Books

1. Kundu, Cohen, Dowling, “Fluid Mechanics”, Elsevier India.
2. Chaim Gutfinger David Pnueli, “Fluid Mechanics” Cambridge University press.
3. Edward Shaughnessy, Ira Katz James Schaffer, “Introduction to Fluid Mechanics”,Oxford University Press.
4. Munson, Young and Okiishi, “Fundamentals of Fluid Mechanics”, Wiley India.
5. Potter Wiggert, “Fluid Mechanics”, Cengage Learning.
6. Fox, Pichard, “Introduction to Fluid Mechanics”, McDonald- Wiley.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312209: Engineering Materials and Metallurgy**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

**Course Objectives:**

**The objective of this course is to provide a comprehensive study on:**

1. Engineering material, crystal structures, their properties and plastic deformation.
2. Solidification and phase diagrams.
3. Heat treatment processes.
4. Properties and applications of ferrous and non-ferrous materials.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Understand basic knowledge related to engineering materials and Calculate Atomic Packing Fraction (APF) of different Crystal structure.

**CO2:** Interpret phase diagram and make use of this knowledge to illustrate the Iron-Iron carbide equilibrium diagram.

**CO3:** Understand basic knowledge related to heat treatment process and Differentiate various heat treatment processes.

**CO4:** Identify and Differentiate ferrous & non-ferrous materials and their applications in formation of different alloys.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312209: Engineering Materials and Metallurgy**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Basics of Engineering Materials** **(7 Hrs.)** | **CO** |
| Basics of engineering materials. Materials classification, material properties: mechanical, thermal and others. Study of crystal structure, imperfections in crystal, structure-property correlation of materials, indexing of lattice planes and directions, miller indices, Mechanism of plastic deformation: slip, dislocation & twinning. | | **CO1** |
| **Unit 2** | **Solidification and Phase Diagram** **(7 Hrs.)** | **CO2** |
| Study of solidification of pure metal, solid solution & their types, Formation of Alloy, Hume Rothery Rule, grain shape & size, its effect on the properties. Phase Diagrams, Phase rule, microstructural changes during cooling, Lever rule, Invariant reactions, Study of Fe Fe-C diagram - uses & limitations. | | |
| **Unit 3** | **Heat Treatment Processes** **(7 Hrs.)** | **CO3** |
| Basics of Heat treatment of steel: Annealing, tempering, normalizing, spheroidising and hardening. Isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening, Jomini End Quench test for hardenability. | | |
| **Unit 4** | **Ferrous and Non-ferrous alloys** **(7 Hrs.)** | **CO4** |
| Structure and properties of plain carbon steel, Effect of Impurities, Alloy steel, Effects of various alloying elements, Tool steel, Red hardness; Stainless steel; Hadfield Manganese steel, Maraging Steel, O.H.N.S. Steel, Selection of steel for various applications. Cast iron – Classification and properties, Ni – hard & Ni – Resist cast iron, Meehanite Alloy. Study of non- ferrous alloys – Brasses, its types, Cu-Zn diagram; Bronzes, its types, Cu-Sn diagram; Al-Si diagram. | | |

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312209: Engineering Materials and Metallurgy**

## Text Books


1. Materials Science & Metallurgy, Dr. V. D. Kotgire, Everest Publishing House
2. Introduction to Physical Metallurgy, Sidney H. Avner, Tata McGraw-Hill
3. Introduction to Engineering Materials, B. K. Agrawal, Tata McGraw-Hill
4. Engineering Materials & Metallurgy, Srinivasan, Tata Mc-Graw Hill.


## Reference Books


1. Materials Science, Willium Callister, John Wiley & Sons
2. Material Science, Narula & Gupta, Tata Mc-Graw Hill
3. Material Science & Metallurgy, Parashivamurthy, Pearson
4. A First course on Material Science, Raghavan, PHI Learning.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312210: Mechatronics**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

**Course Objectives:**

1. Understand the key elements of mechatronics, principle of sensor and its characteristics.
2. Understand the concept of signal processing and use of interfacing systems such as ADC, DAC, Digital I/O.
3. Understand the block diagram representation and concept of transfer function.
4. Understand the system modeling and analysis in frequency domain.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Define key elements of mechatronics, principle of sensor and its characteristics.

**CO2:** Utilize concept of signal processing and MAKE use of interfacing systems such as ADC, DAC, Digital I/O.

**CO3:** Determine the transfer function by using block diagram reduction technique.

**CO4:** Evaluate Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312210: Mechatronics**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Introduction to Mechatronics, Sensors & Actuators** **(07 Hrs.)** | **CO** |
| Introduction to Mechatronics and its Applications Measurement Characteristics (Static/Dynamic),<br>**Sensors:** Types of sensors; Motion Sensors – Encoder (Absolute & incremental), Lidar, Eddy Current, Proximity (Optical, Inductive, Capacitive), MEMS Accelerometer;<br>Temperature sensor –Pyrometer, Infrared Thermometer; Force / Pressure Sensors – Strain gauges, Piezoelectric sensor; Flow sensors – Electromagnetic, Ultrasonic, Hot-wire anemometer; Color sensor – RGB type; Biosensors – Enzyme, ECG, EMG<br>**Actuators:** Servo motor; Hydraulic and Pneumatic (must be restricted to classification and working of one type of linear and rotary actuator); linear electrical actuators Selection of Sensor & Actuator | | **CO1** |
| **Unit 2** | **Data Acquisition and Signal Communication** **(07 Hrs.)** | **CO2** |
| Signal Communication: Serial, Parallel; Synchronous, Asynchronous<br>Introduction to DAQ, Types, Components of a Data Acquisition System (Sensor, Signal conditioning, processing, controlling and storage/display/action)<br>Data Acquisition: Signal collection, Signal conditioning – Isolation& Filtering, Amplification, Sampling, Aliasing, Sample and hold circuit, Quantization, Analog-to-digital converters (4 bit Successive Approximation type ADC), Digital-to-Analog converters (4 bit R2R type DAC), Data storage Applications: DAQ in Household ,Digital Pressure Gauge, Digital Flow measurement, DVB Digital Video Broadcast, AM/FM | | |
| **Unit 3** | **Control systems & transfer function based modelling** **(07 Hrs.)** | **CO3** |
| Introduction to control systems, need, Types- Open and Closed loop, Concept of Transfer Function, Block Diagram & Reduction principles and problems; Applications (Household, Automotive, Industrial shop floor)<br>Transfer Function based modeling of Mechanical, Thermal and Fluid system; Concept of Poles & Zeros; Pole zero plot, Stability Analysis using Routh Hurwitz Criterion (Numerical | | |

| | | |
|---|---|---|
| Approach) | | |
| **Unit 4** | **Time and Frequency Domain Analysis** **(07 Hrs.)** | **CO4** |
| Time Domain Analysis – Unit step Response analysis via Transient response specifications (Percentage overshoot, Rise time, Delay time, Steady state error etc.)<br>Frequency Domain Analysis – Frequency Domain Parameters - Natural Frequency, Damping Frequency and Damping Factor; Mapping of Pole Zero plot with damping factor, natural frequency and unit step response ; Introduction to Bode Plot, Gain Margin, Phase Margin | | |

## Text Books

1. William Bolton, Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering, 6th Ed, 2019.
2. K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008.

## Reference Books

1. Alciatore and Histand, Introduction to Mechatronics and Measurement Systems, 5th Ed, 2019.
2. Bishop (Editor), Mechatronics – An Introduction CRC 2006.
3. Mahalik, Mechatronics – Principles, concepts and applications, Tata Mc-Graw Hill publication, New Delhi.
4. C.D.Johnson, Process Control Instrumentation Technology, Prentice Hall,New Delhi.
5. Bolton, Programmable Logic Controller, 4th Ed, Newnes, 2006.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312211: Kinematics of Machinery Lab**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: 01** | | **End-Sem: --** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **25** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.
2. To develop the competency to analyze the velocity and acceleration in mechanisms using analytical Method
3. To develop the competency to analyze the velocity and acceleration in mechanisms using graphical approach.
4. To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.
5. To develop the competency to understand & apply the principles of gear theory to design various applications.
6. To develop the competency to design a cam profile for various follower motions.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Apply kinematic analysis to simple mechanisms

**CO2:** Analyze velocity and acceleration in mechanisms by vector and graphical method

**CO3:** Synthesize a four bar mechanism with analytical Method

**CO4:** Synthesize a four bar mechanism with graphical methods

**CO5:** Apply fundamentals of gear theory as a prerequisite for gear design

**CO6:** Construct cam profile for given follower motion

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312211: Kinematics of Machinery Lab**

**Practical Work:-**

**The student shall complete the following Experiments as a Lab Work.**

| | | |
|---|---|---|
| Expt. No. 1 | To make a model of any mechanism by using waste material by the group of 4 to 6 students and to give a presentation using PPTs. | **CO1** |
| Expt. No. 2 | Speed and torque analysis of epicyclic gear train to determine holding torque. | **CO5** |
| Expt. No. 3 | To study and verify cam jump phenomenon. | **CO6** |
| Expt. No. 4 | To study manufacturing of gear using gear generation with rack as a cutter and to generate an involute profile. | **CO1** |
| Expt. No. 5 | To solve two problems on velocity and acceleration analysis using relative velocity and acceleration method. | **CO3** |
| Expt. No. 6 | To solve two problems on velocity analysis using the ICR method. | **CO3** |
| Expt. No. 7 | To study various types of gearboxes. | **CO5** |
| Expt. No. 8 | To draw cam profile for any two problems with combination of various follower motion with radial and off-set cam. | **CO6** |

## Text Books


1. S. S. Rattan, “Theory of Machines”, Third Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Bevan T, “Theory of Machines”, Third Edition, Longman Publication
3. G. Ambekar, “Mechanism and Machine Theory”, PHI
4. J. J. Uicker, G. R. Pennock, J. E. Shigley, “Theory of Machines and Mechanisms”, Fifth Edition, International Student Edition, Oxford.


## Reference Books

1. Paul E. Sandin, “Robot Mechanisms and Mechanical Devices Illustrated”, Tata McGraw Hill Publication
2. Stephen J. Derby, “Design of Automatic Machinery”, 2005, Marcel Dekker, New York
3. Neil Sclater, “Mechanisms and Mechanical Devices Sourcebook”, Fifth Edition, Tata McGraw Hill Publication
4. Ghosh Malik, “Theory of Mechanism and Machines”, East-West Pvt. Ltd.
5. Hannah and Stephans, “Mechanics of Machines”, Edward Arnolde Publication
6. R. L. Norton, “Kinematics and Dynamics of Machinery”, First Edition, McGraw Hill Education (India) P Ltd. New Delhi
7. Sadhu Singh, “Theory of Machines”, Pearson
8. Dr. V. P. Singh, “Theory of Machine”, Dhanpatrai and Sons
9. C. S. Sharma & Kamlesh Purohit, “Theory of Machine and Mechanism”, PHI.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312212: Fluid Mechanics Lab**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: 01** | | **End-Sem: --** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **25** |
| | | **Termwork** | **--** |

## Course Objectives:

1. Identify various properties of fluids and its use units.
2. State and illustrate the basics Fluid Statics
3. To identify various types of flows
4. Applications of Bernoulli's Equation for various applications
5. To identify the sources of energy and their conversions
6. Identify and explain the fluid properties and concepts of Boundary layer, Drag Lift.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Able to explain the effect of fluid properties on a flow system.

**CO2:** Calculate the hydrostatic pressure and force on plane and curved surfaces

**CO3:** Able to identify type of fluid flow patterns and describe continuity equation

**CO4:** Identify how to derive basic equations and know the related assumptions.

**CO5:** Apply the equation of the conservation of energy.

**CO6:** Apply the similitude concept and set up the relation between a model and a prototype

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312212: Fluid Mechanics Lab**

**Practical Work:-**

**The student shall complete the following Experiments as a Lab Work.**

| | | |
|---|---|---|
| | **Group -A** | |
| Expt. No. 1 | Determination of fluid viscosity and its variation with temperature | **CO1** |
| Expt. No. 2 | Determination of pressure using manometers (minimum two) | **CO2** |
| Expt. No. 3 | Determination of Metacentric height of floating object | **CO2** |
| Expt. No. 4 | Verification of modified Bernoulli's equation. | **CO4** |
| Expt. No. 5 | Calibration of Orifice meter/ Venturimeter. | **CO4** |
| Expt. No. 6 | Calibration of Notch | **CO4** |
| Expt. No. 7 | Determination of minor/major losses through metal/non-metal pipes. | **CO5** |
| Expt. No. 8 | Determination of Reynolds number and flow visualization of laminar and turbulent flow using Reynolds apparatus. | **CO5** |
| | **Group -B** | |
| Visit | Mini project/Industrial visit/Simulation of fluid flow/Programming using any suitable software. (Industrial Visit to Hydro power Plant/Pumping Station.) | **CO5,CO6** |

## Text Books


1. Sukumar Pati, "Fluid Mechanics and Hydraulics Machines", TATA McGraw Hill.
2. Modi P. N. and Seth S. M, "Hydraulics and Fluid Mechanics",Standard Book House.
3. Cengel & Cimbla, "Fluid Mechanics",TATA McGraw-Hill.
4. F. M. White, "Fluid Mechanics", TATA McGraw-Hill.
5. R. K. Bansal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publication.
6. Theory of hydraulic Machinery, V. P. Vasandani.
7. Hydraulic Machines, J. Lal, Metropolitan Book.


## Reference Books

1. Kundu, Cohen, Dowling, “Fluid Mechanics”, Elsevier India.
2. Chaim Gutfinger David Pnueli, “Fluid Mechanics” Cambridge University press.
3. Edward Shaughnessy, Ira Katz James Schaffer, “Introduction to Fluid Mechanics”,Oxford University Press.
4. Munson, Young and Okiishi, “Fundamentals of Fluid Mechanics”, Wiley India.
5. Potter Wiggert, “Fluid Mechanics”, Cengage Learning.
6. Fox, Pichard, “Introduction to Fluid Mechanics”, McDonald- Wiley.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312213A: Robotics**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| **Practical: --** | **Practical: --** | | **End-Sem: 50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

**Course Objectives:**

1. To make students aware with fundamentals of robotics, components of a robotic system, types of manipulators, degree of freedom of a manipulator, robot specifications etc.
2. To make students understand the kinematics of a robotic system in order to plan required positioning and orientation.
3. To develop skills so that students can analyze for appropriate trajectories for motion of a manipulator and solve for joint torques using robot dynamics.
4. To develop skills so that students can implement PID controller with mechanisms.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Differentiate between types of robots, interpret the system for mobilities

**CO2:** Apply the knowledge to specify a robot based on requirement

**CO3:** Design a robotic manipulator with respect to kinematic analysis depending on the expected mobilities (degrees of freedom).

**CO4:** Select appropriate trajectory based on work space requirements

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312213A: Robotics**

| Units | |
|---|---|
| **Basics of robotics** **(7 Hrs.)** | **CO** |
| Introduction to robotics, history of robotics, components of a robotic system, types of joints, types of manipulators, degree of freedom of different manipulators, classification of robots, work-space of robots, types of end effectors, concept of resolution, accuracy and repeatability, robot teaching methods, specification of robots. | **CO1** |
| **Robot Coordinate Systems & Work Space** **(7 Hrs.)** | **CO2** |
| Types of Robot Coordinate Systems: Cartesian, Cylindrical, Spherical, Derivation of transformation matrix for different coordinate system, Methods of specifying orientation, design of serial manipulator mechanism based on workspace requirements. | |
| **Kinematics of robots** **(7 Hrs.)** | **CO3** |
| Representation of an object in 3D space, frame transformation, composite rotation matrix, representation of frame in other systems (position in cylindrical, spherical and orientation in roll, pitch and yaw and Euler Angles system), Denavit-Hartenberg notations, forward and inverse kinematics, velocity analysis. | |
| **Trajectory planning** **(7 Hrs.)** | **CO4** |
| Slope, deflection and radius of curvature, Relation between slope, deflection and radius of curvature, Derivation of differential equation of elastic curve, Double integration method, Macaulay's method, Castigliano's theorem. | |

## Text Books


1. Fundamental of Robotics by D.K. Pratihar, Narosa Publications.
2. Robotics by K.S. Fu, R. Gonzalez and C.S.G. Lee, Mc Graw Hill Publications.
3. Introduction to Robotics by J.J. Craig, Pearson Education Publications.


## Reference Books

1. Industrial Robotics by M.P. Groover, Mc Graw Hill Publications.
2. Robotics for Engineers by Y. Koren, Mc Graw Hill Publications.
3. Robotics Engineering, Richard D. Klafter, PHI.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312213B: Automation in Manufacturing**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| **Practical: --** | **Practical: --** | | **End-Sem: 50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

**Course Objectives:**

1. To develop the understanding of basic automation theory.
2. To understand industrial automation.
3. To classify different production line system.
4. To identify modern techniques used in the field of automation.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Understand the fundamentals of automation theory.

**CO2:** Develop the numerical control part program and explain its role in automation.

**CO3:** Examine the performance of material handling systems using analytical methods.

**CO5:** Explain the various methods of automated inspection and the concepts of group technology.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312213B: Automation in Manufacturing**

| **Units** | |
|---|---|
| **Introduction to Automation** **(7 Hrs.)** | **CO** |
| Definition, types, reasons, strategies, organization, and information processing in manufacturing. Automated flow lines, methods of work part transport, buffer storage. Analysis of flow lines: analysis of transfer lines without storage, partial automation, and manual assembly lines. Assembly line balancing, methods of line balancing. (Largest Candidate rule & Ranked Position Weighted Method) | **CO1** |
| **Numerical Control Production Systems** **(7 Hrs.)** | **CO2** |
| Basic concepts, coordinate system, and machine motion. Types of NC systems, tape and tape readers, tape formats, methods of part programming, manual part programs (NC words): APT programming, computer numerical control, directed numerical control, and applications of NC. | |
| **Automated Material Handling and Storage** **(7 Hrs.)** | **CO3** |
| Automated inspection principles & methods, off-line & on -line inspection, distributed inspection & final inspection, sensor technologies, automated inspection, coordinate. Measuring machine construction, operation & benefits, machine vision image acquisition & digitization, image processing & analysis, interpretation, machine vision applications, group technology: part families, parts classification & coding, Optiz classification systems production. Flow analysis; machine cell design composite pat concept, types of cell design, best machine arrangement, benefits of group technology. | |
| **Automated Inspection & Group Technology** **(7 Hrs.)** | **CO4** |
| Automated inspection principles & methods, off-line & on -line inspection, distributed inspection & final inspection, sensor technologies, automated inspection, coordinate. Measuring machine construction, operation & benefits, machine vision image acquisition & digitization, image processing & analysis, interpretation, machine vision applications, group technology: part families, parts classification & coding, Opitz classification systems production. Flow analysis; machine cell design composite pat concept, types of cell design, best machine arrangement, | |

| | |
|---|---|
| benefits of group technology. | |

## Text Books

1. Automation, production System & CIMS, M. P. Groover, 4th Edition 2014, Prentice Hall of India.
2. Industrial Robotics, M. P. Groover, Roger N. Nagel, 2nd Edition 2017, Mc Grow-Hill.
3. NC Machines, M. Adithan & B. S. Pabla, 3rd Edition 2018, New Age International Publications New Delhi.

## Reference Books

1. CAD/CAM: M. Groover& E. Zimmers, 6th Edition 2014, Pearson Education.
2. Industrial Engg. & Production Management, Martand Telsang, Revised Edition 2018, S. Chand Publications.
3. Computer Control of Manufacturing Systems, Yoram Koren, 1st Edition 2017, McGraw Hill.

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common)** ***(2023 Pattern)***

Sem-IV

**2300205A : German Language**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| Practical: Nil | | | **End-Sem:50** |
| | | **Pract:** | **--** |
| | | **Oral:** | -- |
| | | **Termwork** | **--** |

**Course Objectives: The student should be able to**

1. Understand grammar & structure of the German language and use it in daily basic conversations and communication
2. Speak and write German language
3. Critically think in German

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** do the proper pronunciation of the sounds of the German language
**CO2:** understand a basic vocabulary
**CO3:** comprehend the basic grammatical structures.
**CO4:** understand German that is spoken at a moderate conversational speed andthat deals with everyday topics and will be able to engage in simple conversations in everydaysituations.
**CO5:** demonstrate that they can think critically, read& write with a basic knowledge of non-technical German

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common)** ***(2023 Pattern)***

Sem-IV

**2300205A : German Language**

| **Module 1: Introduction** **7Hrs** | **CO** |
|---|---|
| Greetings , Introduction To Basic Phonetics; Writing System; Tones; Spelling Rules , Introducing Oneself And Others , Talk About Family and Family Members, Express likes and dislikes , Hobbies, Asking For Personal Information ,Talking About Date, Month, Year, Talking About Time ,Talking About Age | CO1 |
| **Module 2: Grammar** **7Hrs** | CO1 , CO2, CO3 |
| Alphabet- Numerals - Nominal Classifiers – Sentences with Adjectival Predicate – Names of Countries and places- Personal Pronoun- Interrogative Sentences - Structural Particle - Verbs and Verb Conjugation – Articles- Singular and Plural- Prepositions – Negative articles – Ja/Nein and W-Fragen (Yes/No and W- Questions) - Negation – Adjective- Possessive Article – Nominative and Accusative cases – Writing notes, SMS and filling up forms- Listen and Understand Telephonic Conversation and Conversations at specific places- Songs and Quiz | |
| **Module3: Oral Communication** **7Hrs** | CO4, CO5 |
| Stellungnahme (Taking a particular stance on a given topic)/ Debate/ Discussions/ Interview/ Role play/ group discussion/ Narration, interview skills etc. | |
| **Module4:Writing Communication** **7Hrs** | CO1 & CO5 |
| Writing skills: Formal and Informal letters, Email, SMS blogs, Essays, Report, Article, statistical Analysis, book/Film review etc | |

**Text Books:**


1. Kraft, Wolfgang S. Deutsch Aktuell 1, 7th edition (2017). St. Paul: EMC/ParadigmPublishing. ISBN 978-0-8219-8076-7
2. Kraft, Wolfgang S. Deutsch Aktuell 1 Workbook, 7th edition (2017). St. Paul:EMC/Paradigm Publishing. ISBN 978-0-8219-8078-1


**Reference books:**


1. Funk, Hermann u.a. (hrsg.): Studio D A1. Deutsch AlsFremdsprache. Kurs Und Übungsbuch.Cornelsen and GOYAL SaaB. , 2009.
2. Funk, Hermann, u.a. (hrsg.): Studio D A1. Deutsch AlsFremdsprache. Sprachtraining. Cornelsenand GOYAL SaaB. , 2009.
3. Hirschfeld, Ursula, Reinke, Kerstin, Stock, Eberhard (hrsg.): Phonothekintensiv. München.Langenscheidt, 2007.
4. Studio 21 A1 Glossardeutsch-englisch, CornelsenVerlag, Berlin, 2013.
5. Tangram aktuell 1, Max HueberVerlag, Ismaning 2005 and GOYAL Publishers, Delhi2005.
6. Swick, Ed: Complete German Grammar.Mcgraw-Hill Publ. Comp. New York City, 2012.
7. Evans, Richard J.: Rereading German History, 1800-1996. From Unification to
8. Reunification.Routledge.London& New York, 1997.
9. Fraser, Catherine C. & Hoffmann, Dierk O. (hrsg.): Pop Culture in Germany! Media, Art andLifestyle.ABC-CLIO.England, 2006.

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common)** ***(2023 Pattern)***

Sem-IV

## 2300205B : French Language

| Teaching Scheme: | Credits | Examination Scheme | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| Practical: Nil | | | **End-Sem:50** |
| | | **Pract:** | **--** |
| | | **Oral:** | -- |
| | | **Termwork** | **--** |

**Course Objectives: The student should be able to**

1. Understand grammar & structure of the French language and use it in daily basic conversations and communication
2. Speak and write French language
3. Critically think in French

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** do the proper pronunciation of the sounds of the French language
**CO2:** understand a basic vocabulary
**CO3:** comprehend the basic grammatical structures.
**CO4:** understand French that is spoken at a moderate conversational speed andthat deals with everyday topics and will be able to engage in simple conversations in everydaysituations.
**CO5:** demonstrate that they can think critically, read& write with a basic knowledge of non-technical French

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common) *(2023 Pattern)***

Sem-IV

**2300205B : French Language**

| **Module 1: Introduction** **7Hrs** | **CO** |
|---|---|
| Greetings , Introduction To Basic Phonetics; Writing System; Tones; Spelling Rules , Introducing Oneself And Others , Talk About Family and Family Members, Express likes and dislikes, Hobbies, Asking For Personal Information ,Talking About Date, Month, Year, Talking About Time, Talking About Age | CO1 |
| **Module 2: Grammar** **7Hrs** | CO1, CO2, CO3 |
| Alphabet- Numerals - Nominal Classifiers – Sentences with Adjectival Predicate – Names of Countries and places- Personal Pronoun- Interrogative Sentences - Structural Particle - Verbs and Verb Conjugation – Articles- Singular and Plural- Prepositions – Negative articles –- Negation – Adjective- Possessive Article – Nominative and Accusative cases – Writing notes, SMS and filling up forms- Listen and Understand Telephonic Conversation and Conversations at specific places- Songs and Quiz | |
| **Module3:Oral Communication** **7Hrs** | CO4, CO5 |
| Stellungnahme (Taking a particular stance on a given topic)/ Debate/ Discussions/ Interview/ Role play/ group discussion/ Narration, interview skills etc. | |
| **Module4:Writing Communication** **7Hrs** | CO1, CO5 |
| Writing skills: Formal and Informal letters, Email, SMS blogs, Essays, Report, Article, statistical Analysis, book/Film review etc | |

**Text Books:**


1. Alter Ego, A1 (ISBN: 9782011554208); Publisher: Hachette; Author: Annie Berthet, Catherine Hugot et al.; Published: 2006;
2. Alter Ego, A1 – Cahier d'activités - A1 (ISBN: 9782011558114); Publisher: Hachette; Author:Annie Berthet, Catherine Hugot et al.; Published: 2006


**Reference books:**


1. Écho (2e edition), A1 (ISBN: 9782090385885); Publisher: CLE International; Authors: Jacky Girardet, Jacques Pecheur; Published: 2013
2. Écho (2e edition), A1 - Cahier personnel d'apprentissage (ISBN: 9782090385892); Publisher: CLE International; Authors: Jacky Girardet, Jacques Pecheur; Published: 2013.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech*(2023 Pattern)***

Sem-IV

2300206:Industrial Economics

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| | | | **End-Sem:50** |
| | | **Pract:** | **--** |
| | | **Oral:** | -- |
| | | **Term work** | -- |

**Course Objectives: The student should be able to**

1. Upon completion of the course, students will gain comprehensive knowledge of industrial organization, serving as a cornerstone for exploring various interconnected fields within the industry.
2. Students will develop a profound understanding of how firms interact within the economy, encompassing areas such as business strategy, corporate finance, marketing, international trade, banking, and organizational economics.
3. The course will offer insights into the historical progression of industrial economies, with a primary focus on contemporary advancements in studying firms' behavior.
4. By the end of the curriculum, learners will be equipped with a holistic perspective on industrial organization, paving the way for exploration into numerous other disciplines linked to the industrial sector.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Including its definition, scope, and economic significance in various sectors.

**CO2:** Learners will recognize the importance of studying Industrial Economics and its role in economic analysis, decision-making, and influencing diverse fields such as marketing, finance, and international trade.

**CO3:** analyze the interplay between economic development and industrialization, as well as the impact of industrialization on the agricultural sector.

**CO4:** Learners will identify and assess key factors influencing industrial development, considering socioeconomic and political influences on industrial growth.

**CO5:** By the end of the course, students will comprehend the dynamics of competition and cooperation among firms, their implications on industrial outcomes, and the strategies like mergers, takeovers, and acquisitions.

**CO6:** Learners will be equipped to analyze industrial location decisions, determine the determinants of industrial location, and evaluate theories like Weber's and Florence's to understand industrial location patterns.

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech*(2023 Pattern)***

Sem-IV

2300206:Industrial Economics

| **Unit 1 - Introduction to Industrial Economics** **7hrs** | **CO** |
|---|---|
| Definition of Industrial Economics and its scope of study, Understanding the industrial sector's economic significance, Importance of Industrial Economics, Need and Significance of Studying Industrial Economics, Role of Industrial Economics in Economic Analysis, Economic Development, Agricultural Development, and Industrialization, Interplay between Economic Development and Industrialization, Impact of Industrialization on Agricultural Sector, Factors Influencing Industrial Development, Analysis of Key Factors Affecting Industrial Growth, Socioeconomic and Political Factors in Industrial Development. | CO1, CO2 |
| **Unit 2- Industrial Decisions and Market Structure.** **7hrs** | |
| Competition and Cooperation in Industries, The concept of Competition and Cooperation among Firms, Implications of Different Approaches on Industrial Outcomes, Firm Behavior and Market Outcomes, Understanding Firm Behavior under Different Market Structures, Relationship between Firm Behavior and Market Outcomes, Cartels, Collusion, Mergers, Takeovers, and Acquisitions, Overview of Cartels and Collusion in Industries, Merger, Takeover, and Acquisition Strategies. | CO3, CO4 |
| **Unit 3- Price Competition and Pricing Strategies** **7hrs** | |
| Factors Influencing Pricing Decisions, General Considerations for Pricing Decisions in Various Industries, Market Conditions and Pricing Strategies, Pricing under Perfect & Imperfect Competition: Theoretical Perspectives, Pricing Strategies in Perfectly Competitive Markets, Pricing Challenges in Imperfectly Competitive Markets, Pricing Procedures and Methods in Practice, Practical Approaches to Pricing Decisions, Comparative Analysis of Pricing Methods, Pricing in Public Enterprises, Pricing Policies and Practices in Public Sector Enterprise, Economic and Social Implications of Public Enterprise Pricing, Price Wars: Theories and Empirical Evidence, Theoretical Explanations of Price Wars, Empirical Evidence and Impact on Industries | CO5 |
| **Unit 4 - Non-Price Competition and Product Differentiation** **7hrs** | |
| Non-Price Competition and Product Differentiation, Understanding Non-Price Competition and Product Differentiation, Importance of Product Differentiation in Competitive Markets, Horizontal Product Differentiation, Analysis of Horizontal Product Differentiation and Consumer Behavior, Case Studies and Examples, Brand Proliferation as an Entry Deterrence Strategy, The Role of Brand Proliferation in Deterring New Entrants, Evaluation of Effectiveness and Challenges, Vertical Product Differentiation, Explanation of Vertical Product Differentiation and its Implications, Comparison with Horizontal Differentiation, Price Discrimination: First-, Second-, and Third-Degree Price Discrimination. | CO6 |

**Text Books:**


1. “Modern Small Industry in India" -R. K. Vepa
2. “Problems of Accountability of Public Enterprises in India" -M. P. Srivastava
3. “Economic Development Perspectives, Vol. 3, Public Enterprises and Performance" -Binode Mohanty
4. “Public Enterprises in India - Principles and Performance" - V. K. L. Srivastava

**Reference Books / Reading:**

1. “Industrial Economics - Issues and Perspectives"- Paul R. Ferguson and Glenys J. Ferguson
2. “The Economics of Industrial Organization" - William G. Shepherd
3. “Modern Small Industry for Developing Countries"- E. Staley and R. Morse
4. “Indian Growth and Stagnation - The Debate in India" - A. V. Desai

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312702: Refrigeration System Maintenance**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: 01** | | **End-Sem: --** |
| **Prerequisite : Nil** | | **Pract:** | **25** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. The concepts, principles of working of RAC systems.
2. The knowledge of testing procedure of components used in RAC and making use of different test instruments.
3. The concepts and principles used in RAC Systems and its maintenance.
4. To locate the fault at component level and at the stage level.
5. Study of the safety controls employed in refrigeration air conditioning systems.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Illustrate the fundamental principles and applications of refrigeration and air conditioning system.

**CO2:** Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems.

**CO3:** Present the properties, applications and environmental issues of different refrigerants

**CO4:** Calculate cooling load for air conditioning systems used for various applications

**CO5:** Operate and analyze the refrigeration and air conditioning systems

SANDIP FOUNDATION

# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312702: Refrigeration System Maintenance**

**Practical Work:-**

**The student shall complete the following activity as a practical work.**

| | | |
|---|---|---|
| | **Group -A** | |
| Expt. No. 1 | Testing of a refrigeration system to find out: (a) Refrigerating capacity (b) Power input (c) C.O.P. | **CO1** |
| Expt. No. 2 | Air removal and charging of a refrigeration unit. | **CO2** |
| Expt. No. 3 | Leak detection in refrigeration system by different methods. | **CO3** |
| Expt. No. 4 | Determination of psychrometric properties of air with the help of a sling psychrometer and aspiration psychrometer. | **CO4** |
| Expt. No. 5 | Determination of bye pass factor of a cooling coil. | **CO2 CO4** |
| Expt. No. 6 | Determination of humidifying efficiency of an evaporative cooler. | **CO3 CO4** |
| Expt. No. 7 | Determination of cooling load for a specified situation. | **CO5** |
| | **Group -B** | |
| Visit | Study of the following system by visit: (a) Ice Plant (b) Cold storage plant (c) Control air conditioning system | **CO4,CO5** |

## Text Books


1. Arora C. P., Refrigeration and Air Conditioning, Tata McGraw-Hill.
2. Manohar Prasad, Refrigeration and Air Conditioning, Willey Eastern Ltd, 1983.
3. Mc Quiston, ― Heating Ventilating and air Conditioning: Analysis and Design‖ 6th Edition, Wiley India.
4. Arora and Domkundwar, Refrigeration & Air Conditioning, Dhanpatrai& Company, New Delhi.
6. Khurmi R.S. and Gupta J.K., Refrigeration and Air conditioning, Eurasia Publishing House Pvt. Ltd, New Delhi,1994.
5. Ballaney P.L., Refrigeration and Air conditioning, Khanna Publishers, New Delhi, 1992.


## Reference Books


1. Dossat Ray J, Principles of refrigeration, S.I. version, Willey Eastern Ltd, 2000

2. Stockers W.F and Jones J.W., Refrigeration and Air conditioning, McGraw Hill International editions 1982.
3. Threlkeld J.L, Thermal Environmental Engineering, Prentice Hall Inc., New Delhi.
4. Aanatnarayan, Basics of refrigeration and Air Conditioning, Tata McGraw Hill Publications.
5. Roger Legg, Air Conditioning System Design, Commissioning and Maintenance.
6. ASHRAE & ISHRAE handbook.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312802: Preventive Maintenance in Bearings**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: --** | **Practical: --** | | **End-Sem: --** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

**Course Objectives:**

1. To impart knowledge about failure prevention in bearings.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Understand the importance of inspection of bearings.

**CO2:** Analyze the bearing conditions after usage.

**CO3:** Understand the reasons behind failure of bearings.

**CO4:** Inspect the bearing for preventive maintenance.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2312802: Preventive Maintenance in Bearings**

| Modules | Topics covered | CO |
|---|---|---|
| 1 | **Inspection of Bearing**<br>Inspection of a machine's bearings during operation is important to prevent unnecessary bearing failure. The following methods are generally adopted to inspect the bearing.<br>a) Inspection when machine is running<br>b) Inspection of bearings after operation<br>**(3 Hrs.)** | **CO1** |
| 2 | **Check Bearing after Operation**<br>Bearings after operation and those removed during periodic inspection should be carefully checked visually for symptoms on each component to evaluate whether the bearings' operating conditions are satisfactory. If any abnormality is detected, find the cause and apply a remedy by checking the abnormality against the failure cases.<br>**(4 Hrs.)** | **CO2** |
| 3 | **Bearing Failures**<br>The bearing is generally usable up to the end of the rolling fatigue life if handled properly. If it fails earlier, it may be due to some fault in the selection, handling, lubrication, and/or mounting of the bearing. It is sometimes difficult to determine the real cause of bearing failure because many interrelated factors are possible. It is, however, possible to prevent the recurrence of similar problems by considering possible causes according to the situation and condition of the machine on which the bearings failed. Also, installation location, operating conditions, and surrounding structure of the bearings should be taken into consideration.<br>**(4 Hrs.)** | **CO3** |
| 4 | **Important parameters in inspection of bearings**<br>1. Bearing Temperature | **CO4** |

| | | |
|---|---|---|
| | 2. Operating Sound of Bearing<br>3. Vibration in Bearing<br>4. Lubricant Selection (grease or oil)<br>5. Relubrication **(4 Hrs.)** | |

**Expectations:**

Students shall submit a report based on the above modules for the assessment of this course.

**Text Books:-**

1. Rolling Bearing Tribology- Tribology and Failure Modes of Rolling Element Bearings (2022), Gary Doll by Elsevier Science.
2. Bearings Basic Concepts and Design Applications (2018), Maurice L. Adams by CRC Press.

**Reference Books:-**

1. Advanced Concept of Bearing Technology: Rolling Bearing by Tedric A. Harris, Taylor and Francis.
2. Journal Bearing Handbook (2013), J. Mitsui, J. Esaki, S. Saito, Y. Kanemitsu, by Springer Berlin Heidelberg.

## Text Books

1. Rolling Bearing Tribology- Tribology and Failure Modes of Rolling Element Bearings (2022), Gary Doll by Elsevier Science.
2. Bearings Basic Concepts and Design Applications (2018), Maurice L. Adams by CRC Press

## Reference Books

1. Advanced Concept of Bearing Technology: Rolling Bearing by Tedric A. Harris, Taylor and Francis.
2. Journal Bearing Handbook (2013), J. Mitsui, J. Esaki, S. Saito, Y. Kanemitsu, by Springer Berlin Heidelberg.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2300207: Industrial Work Study**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: 2 hrs/week** | **Th:02** | **Theory** | **CIA: 25** |
| **Practical: --** | **Practical: --** | | **End-Sem:50** |
| **Prerequisite : Nil** | | **Pract:** | **--** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

**Course Objectives:**

1. To teach students about how to measure work, optimize methods and fix pay accordingly.

**Course Outcomes:**

**On completion of the course, learner will be able to–**

**CO1:** Explain different method study procedures and can implement them for optimizing work approaches.

**CO2:** Evaluate the work content and can fix standard time for performing work.

**CO3:** Analyze the data through work sampling.

**CO4:** Design the plans for fixing incentive and wages based on performance.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2300207: Industrial Work Study**

| **Units** | | |
|---|---|---|
| **Unit 1** | **Method Study** **(7 Hrs.)** | **CO** |
| Purpose of work study, its objectives, procedure and applications; method study definition and basic procedure, selection of job, various recording techniques like outline process charts, flow process charts, man machine charts, two handed process charts, string diagram, flow diagram, multiple activity chart, simo, cyclographs and chrono-cyclographs; critical examination, development, installation and maintenance of improved method; principles of motion economy and their application in work design; micro motion study, memo motion study and their use in methods study. | | **CO1** |
| **Unit 2** | **Work Measurement** **(7 Hrs.)** | **CO2** |
| Introduction & definition, objectives and basic procedure of work measurement; application of work measurement in industries; time study: basic procedure, equipment needed, methods of measuring time, selection of jobs, breaking a job into elements; numbers of cycles to be timed; rating and methods of rating, allowances, calculation of standard time. | | |
| **Unit 3** | **Work Sampling** **(7 Hrs.)** | **CO3** |
| Basic procedure, design of work sampling study, conducting work sampling study and establishment of standard-time. | | |
| **Unit 4** | **Job Evaluation and Incentive Schemes** **(7 Hrs.)** | **CO4** |
| Starlight line, Tailor, Merrick and Gantt incentive plans, Standard data system; elemental and non-elemental predetermined motion systems, work factors system; Methods, Time Measurement (MTM), MOST | | |

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**2300207: Industrial Work Study**

## Text Books


1. Barrnes RM; Motion and Time Study; Wiley Publications.
2. Currie RM; Work study; BIM publications.


## Reference Books


1. Mynard; Hand book of Industrial Engineering.
2. Telsang, M.; Industrial Engineering and Production Management, S. Chand Publishers.
3. ILO; work-study; International Labour Organization.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**VAC122: Geometric Dimensioning & Tolerancing (GD&T)**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| **Theory: --** | **Th:--** | **Theory** | **CIA: --** |
| **Practical: 2 hrs/week** | **Practical: 01** | | **End-Sem: --** |
| **Prerequisite : Nil** | | **Pract:** | **25** |
| | | **Oral:** | **--** |
| | | **Termwork** | **--** |

## Course Objectives:

1. To understand requirements of industrial drawings
2. To read, understand and explain basic Geometric Dimensioning & Tolerancing concepts
3. To apply various geometric and dimension tolerances based on type of fit
4. To include surface roughness symbols based on manufacturing process
5. To measure and verify position tolerances with applied material conditions
6. To understand requirements for manufacturing and assembly.

## Course Outcomes:

**On completion of the course, learner will be able to–**

**CO1:** Select appropriate IS and ASME standards for drawing

**CO2:** Read & Analyze variety of industrial drawings

**CO3:** Apply geometric and dimensional tolerance, surface finish symbols in drawing

**CO4:** Evaluate dimensional tolerance based on type of fit, etc.

**CO5:** Select an appropriate manufacturing process using DFM, DFA, etc.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech(Mechanical Engineering)**

***(2023 Pattern)***

Sem-IV

**VAC122: Geometric Dimensioning & Tolerancing (GD&T)**

| | |
|---|---|
| **Guidelines for Laboratory Conduction**<br>**The student shall complete the following activity as a practical work.** | |
| • Total 8 Practical Assignments from the following list must be performed.<br>• Term Work of the Student is evaluated based on the completion of Practical, Industrial Visit Report and Group Assignment.<br>• **Practical** (Assignment # 1 to 6 & 10 are compulsory; Select any One from Assignment # 7 to 9)<br>• The student shall complete the following Practical in laboratory. Learner will demonstrate skills to communicate drawings as per industry standards: | **CO** |
| 1. Study of drawing sheet layout, Principles of Drawing and various IS Standards & Conventions in Machine Drawing, Dimensioning practices - Terminology & Basic Rules, Styles, Conventions | **CO1/ CO2/ CO3/ CO4/ CO5** |
| 2. GD&T<br>i. Terminology, Maximum and Minimum Material conditions, Features, Rules for GD&T, Datum Control.<br>ii. Adding GD&T to a Design, Form Tolerances.<br>iii. Orientation Tolerances, Profile Tolerances.<br>iv. Location Tolerances, Run out Tolerances. | |
| 3. Surface finish, Welding symbols | |
| 4. Study and reading of Industrial Drawings to understand standard industrial practices viz. Dimensioning, GD&T, and Surface finish, welding symbols, etc.<br>i. Machine Drawing.<br>ii. Production Drawing.<br>iii. Part Drawing.<br>iv. Assembly Drawing: (i) Assembly Drawing for Design, (ii) Assembly Drawing for Instruction Manuals, (iii) Exploded Assembly Drawing, (iv) Schematic Assembly Drawing, (v) Patent Drawing, etc | |

| | |
|---|---|
| 5. Calculation of Tolerances based on Type of Fits in Assembly. | |
| 6. Tolerance Stacks-Up with suitable examples. | |
| 7. Design for Manufacturing (DFM) with suitable examples | |
| 8. Design for Assembly and Dis-assembly with suitable examples. | |
| 9. Design for Safety with suitable examples. | |
| 10. Industrial visit / Case study | |

**Text Books**

1. Standards: ASME Y14.5 – 2018
2. Narayana, K. L., Kannaiah, P., Venkata Reddy, K., (2016), “Machine Drawing”, 2nd edition, New Age International Publishers, New Delhi, India, ISBN-13: 978-8122440546
3. Bhatt, N. D. and Panchal, V. M., (2014), “Machine Drawing”, Charotar Publishing House Pvt. Ltd, Anand, India, ISBN-13: 978-9385039232.

**Reference Books**

1. Cogorno, G. R., (2020), "Geometric Dimensioning and Tolerancing for Mechanical Design", 3rd edition, McGraw-Hill Education
2. Blokdyk, Gerardus, (2019), "Geometric Dimensioning and Tolerancing: A Complete Guide - 2020 Edition", 5STARCooks
3. Standards: ISO/TR 23605:2018, ISO 1101:2017, SP 46, IS 15054(2001)

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common)** ***(2023 Pattern)***

Sem-IV

**Minor Project (Exit Course)**

| **Teaching Scheme:** | **Credits** | **Examination Scheme** | |
|---|---|---|---|
| Theory: -- | Practical:02 | **Theory** | **CIA: --** |
| Practical: **--** | | | **End-Sem:--** |
| | | **Pract:** | **50** |
| | | **Oral:** | -- |
| | | **Termwork** | -- |

**Course Objectives: The student should be able to**

1. develop ability for the application of fundamental principles and elementary techniques which have been learnt, in developing solutions for real life engineering problems.

**Course Outcomes:**
**On completion of the course, learner will be able to–**

**CO1:** Identify an open ended problem in area of engineering.
**CO2:** Identify the methods and materials required for the project work.
**CO3:** Formulate and implement innovative ideas for social and environmental benefits.
**CO4:** Analyze the results to come out with concrete solutions.
**CO5:** Write technical report of the project apart from developing a presentation.

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# SANDIP INSTITUTE OF TECHNOLOGY AND RESEARCH CENTRE

**S.Y. B. Tech (Common)** ***(2023 Pattern)***

Sem-IV

**Minor Project (Exit Course)**

## PROCEDURE

This subject will be offered to the students who are will to exit second year engineering and opt for UG Diploma after the 4th semester.

Minor Project is an exit course requirement wherein under the guidance of a faculty member, a student is required to do an innovative work with application of knowledge earned while undergoing various courses and laboratories in the course of study.

Minor Project envisages that a student will acquire the ability to use a wide range of the skills learned during their course of study. A student is required to carry out the project work related to Engineering, under the guidance of a faculty member and/or the supervisor of the concerned industry/institute/organization.

The individual student has to undertake the project.

**Duration:** Minor Project to be completed within one month duration for the respective semester/Exit Course. It is to be assessed and evaluated at the end of 4th semester.