IPS Academy
Institute of Engineering & Science, Indore
Mechanical Engineering,
B. Tech, III Sem
Scheme

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work / Lab Work & Sessional		L	T	P	
1.	HSMC-ME301	HSMC	Industrial Psychology & Human Recourse Management	70	20	10	-	-	100	3	-	-	3
2.	PCC-ME 301	PCC	Material Science	70	20	10	60	40	200	3	-	2	4
3.	PCC-ME 302	PCC	Manufacturing Processes	70	20	10	60	40	200	3	-	2	4
4.	PCC-ME 303	PCC	Strength of Materials	70	20	10	60	40	200	2	1	2	4
5.	PCC-ME304	PCC	Thermodynamics	70	20	10	60	40	200	2	1	2	4
6.	MC- 3	MC	Energy & Environmental Engineering	-	-	-	-	-	-	2	-	-	-
Total Academic Engagements and Credits										**15**	**2**	**8**	**19**
Total				**350**	**100**	**50**	**240**	**160**	**900**	**15**	**2**	**8**	**19**

*MST: Minimum of two mid semester tests to be conducted. L: Lecture T: Tutorial P: Practical

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Syllabus

HSMC-ME301	**Industrial Psychology and Human Resource Management**	**03L;0T;0P (03 Hrs)**	**Credits: 03**

Course Objective: This course equips students with human resource management skills to be able to function effectively in their professional career

Course Content:

Module 1 **(06 hrs)**

Introduction & Overview of the course, Changes/Challenges in HRM, Management Theories, Research Methodology & Statistical Tools, Management of Change.

Module 2 **(06 hrs)**

Organizational Culture & Climate, Knowledge Productivity, New Leadership Motivation Theories.

Module 3 **(05 hrs)**

Talent Management, Training & Development, Performance Management.

Module 4 **(05 hrs)**

Selection & Recruitment, Compensation, Unions, Entrepreneurship.

Text and References:

1. Personality and Organization., Argyris C.
2. The Essence of Leadership, Locke, Edwin A.
3. Organisational Behaviour, Robbins S
4. Managing Human Resources, Bach, S. 2005
5. Human Resource Management: A Contemporary Approach, Claydon, T and J. BeardwellFolger, R. and R.

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PCC-ME301	**Material Science**	**2L: 1T: 2P (05hrs)**	**Credits:04**

Prerequisite(s): Basics of organic chemistry

Course Objective's:

- Materials engineering is concerned with the use of fundamental and applied knowledge of materials.
- To know the change of crystal structure of different materials and its application.
- To understand different materials and its uses in different application.

Course Content:

Module 1 **(09 hrs)**

Crystallography: Atomic structure, crystal structure, miller indices, crystal defects, diffusion of solid, Dislocation, Edge dislocation, Screw dislocations, Slip planes. Stress fields of dislocations. Grain size, grain boundaries, dislocation densities, Dislocation and crystal growth.

Module 2 **(09 hrs)**

Equilibrium Diagram: Various types of phase diagrams, Allotropy structure of alloys, Lever rule, phase rule, Cooling curves, Iron carbide equilibrium diagram, Types of Cast Iron. Types of Stainless Steels, TTT diagram, CCT diagram, Heat treatment of steels and alloys, Hardening, Hardenability, Surface hardening of Steel, Defects in heat treated Parts, Strengthening mechanisms, Corrosion and its prevention.

Module 3 **(07 hrs)**

Destructive and Non- Destructive Testing: Tensile test, Compression test, shear test, bend test, Different types of Hardness tests, Impact tests, Fatigue tests, Hardenability test, NDT Methods – LPI, MPI , Ultrasonic test, Radiography test, Eddy current test.

Module 4 **(08 hrs)**

Fracture Mechanics and Powder Metallurgy: Fracture mechanics: ductile fracture, brittle fracture, ductile to brittle transition, crack propagation, Griffith Theory, fatigue fracture mechanics, Powder production methods, powder conditioning, sintering, testing of PM components.

Module 5 **(06 hrs)**

Modern Materials: Introduction, classifications of nanomaterials, Methods for creating nanostructures, Properties of nanomaterials, Applications of nanomaterials, Introduction to Rubbers & Elastomer, Introduction to Composite materials.

Course Outcomes:

After completion of this course, the students are able to:

1. Appreciate various crystal structure, miller indices and dislocations.
2. Understand the changes in phases of alloys, cooling curves and heat treatment of metals changes their properties.
3. Perform of various methods available for testing of metals destructively and non-destructively.
4. Understand fracture mechanics and powder metallurgy.
5. Know about various modern materials and significance.

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List of Text Book:

1. William D. Calister “Materials Science and Engineering”, “Wiley”, “Second edition”.
2. V Raghvan “Materials Science and Engineering” “PHI Publication” “Sixth Edition”.
3. G.E. Dieter “Mechanical metallurgy” “TMH Publication” “Third Edition”.

List of Reference Book:

1. William F Smith “Materials Science and Engineering” TMH publication “Fifth Edition”.
2. U C Jindal, Materials Science and metallurgy” Pearson Publication” First Edition”
3. Prashant Kumar “Elements of Fracture Mechanics” TMH Publication” First edition”
4. T Pradeep “A text book of Nanoscience and nanotechnology” TMH Publication” First Edition”

List of Experiment:

1. To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test
2. Preparation of specimen for Metallographic examination and Metallographic study of given specimen through metallurgical microscope.
3. To study hardness as a function of quench rate and investigate the hardenability of steels by Jominy End Quench Apparatus.
4. To gain experience with and understanding of the types, advantages and applications of various NDT methods. To be able to choose the best NDT method for a given part and perform Test on UFD machine.
5. To determine carbon and sulphur contents in iron and steel by Strohlein’s Apparatus.
6. Study of Annealing process of heat treatment and its effect on microstructure and Mechanical Properties.

Virtual Lab Experiment:

1. Material Response to Microstructural, Mechanical, Thermal and Biological Stimuli Lab
2. Microstructural analysis of Stainless Steel
3. Comparison between Mild Steel and Grey Cast Iron
4. Severity of Quenching

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PCC-ME302	**Manufacturing Processes**	**2L: 1T: 2P (05 hrs)**	**Credits:04**

Pre requisite(s): Nil

Course Objective's:

- Get the knowledge of Foundry
- Know various Joining process
- Understand the Forging and Rolling process
- Understand the sheet metal process
- Understand the machine tools, mechanisms and accessories

Module 1 **(10 hrs)**

Foundry –Pattern Making, Moulding and Casting: Types of patterns, Pattern and pattern making, pattern allowances; pattern design considerations, core, core boxes .Types of casting process .Molding and Foundry core sands and their properties, runners, risers, solidification, defects and elimination, molding machines, centrifugal casting, dye casting, shell molding; Lost wax molding; continuous casting gating and gating design. Cupola, electric arc and induction furnaces description and operation.

Module 2 **(10hrs)**

Joining Process: Types of welding ,Gas welding method, flames, gas cutting, Electric arc welding, AC and DC welding machines and their characteristics, flux, electrodes, submerged arc welding, TIG & MIG welding; pressure welding; electric resistance welding spot, seam and butt welding; EBW and LASER welding. Thermit chemical welding; brazing and soldering, welding defects & remedies, safety precautions. Printed circuit board design.

Module 3 **(08 hrs)**

Forging and Rolling: Types of forging operations theory and application of forging processes description; drop and horizontal forging machines. Forging design, Types of Rolling operations, General description of machines and process; rolling of structural section plates and sheets; hot and cold rolling techniques.

Module 4 **(08 hrs)**

Press Working: Description and operation of processes, process of shearing, punching, piercing, blanking, trimming, perfecting, notching, lancing, embossing, coining, bending, forging and drawing; press, tool dies, auxiliary equipment, safety devices, stock feeders, scrap cutters, forces, pressure and power requirements .

Module 5 **(08 hrs)**

Metal Machining: Basics of Lathe machines, operations & components, working principle of shaper & planner, Introduction to milling, grinding and drilling machines. Introduction to additive manufacturing.

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Course Outcomes:

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

1. Develop the basic knowledge of Foundry
2. Understands the knowledge of joining process
3. Understand the Forging and Rolling process.
4. Identify the sheet metal Process
5. Develop the basic knowledge of machine and manufacturing processes.

List of Text Book:

1. Raghuvanshi; Workshop Technology; Dhanpat Rai.
2. P.N Rao : Production technology Volume I&II : TMH
3. Anderson and Tetro; Shop Theory; Mc Graw Hills

List of References Book:

1. Kaushish JP; Manufacturing Processes; PHI Learning.
2. Kalpakjian Producting Engineering PEARSON Education
3. Chapman; Workshop Technology
4. Philip F Ostwald ; Manufacturing Process & systems : John Wiley

List of Experiment:

1. Plain and Taper turning – one job
2. Wooden pattern - one job
3. Mold making (green sand mould) – one job
4. Welding (gas or arc) – one job
5. PCB Making -one job

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PCC-ME303	**Strength of Materials**	**2L:1T:2P (05 hrs)**	**Credits:04**

Pre requisite(s): Engineering Mechanics

Course Objective's:

- To establish an understanding of the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior.
- To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics.
- To discuss the basic mechanical principles underlying modern approaches for design of various types of structural members subjected to axial load, torsion, bending, transverse shear, and combined loading.

Module 1 **(10 hrs)**

Stress and Strain: stresses in members of a structure, axial loading, normal stress, shear stress, analysis of simple structures, stepped rods, members in series and parallel: stress strain diagram, Hooke's law, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain, relation among elastic constants, residual stress, fiber reinforced composite materials, strain energy under axial loads and stresses due to impact of falling weights.

Module 2 **(09 hrs)**

Transformation of Stress and Strain, principal stresses, normal and shear stress, Mohr's circle and its application to two and three dimensional analysis. Thin Pressure vessel, hoop stress, longitudinal stress and radial stress.

Module 3 **(11 hrs)**

Bending: Pure bending, symmetric member, deformation and stress, bending of composite sections, eccentric axial loading, shear force and BM diagram, relationship among load, shear and BM, shear stresses in beams, strain energy in bending, deflection of beams, equation of elastic curve, Macaulay's method and Area moment method for deflection of beams.

Module 4 **(08 hrs)**

Torsion in Shafts: Tensional stresses in shafts, deformation in circular shaft, angle of twist, stepped and hollow transmission shafts, combined bending and torsion.

Module 5 **(10 hrs)**

Theories of Failures: maximum normal stress & shear stress theory; maximum normal and shear Strain energy theory, maximum distortion energy theory; application of theories to different materials and loading conditions.

Columns & Struts: Buckling of columns, Euler's formula for columns with different end conditions and Rankine's formula.

Course Outcomes:

After completion of this course, the students are able to:

1. Illustrate the deformation of material under load by various approaches.
2. Evaluate the principal stresses.
3. Analyze the deformations of beam within elastic limit against bending.

4. Analyze and identify the deformation of rotating element within elastic limit.
5. Apply and analyze various theories of failures for different materials and evaluate the stresses in columns under buckling.

List of Text Book:

1. Ramamurtham, Strength of Materials, Dhanpat Rai Publication
2. S. S. Rattan, Strength of Materials, Tata McGraw Hill Publication
3. R. K. Rajput, Strength of Materials, S. Chand Publication

List of Reference Book:

1. R. C. Hibbeler, Mechanics of Materials, Pearson Education
2. Sadhu Singh; Strength of Materials; Khanna Pub
3. Beer and Johnston, Mechanics of Material, Mc Graw Hill publication
4. J.B. Popov, Introduction to Mechanics of Solids, Prentice – Hall publication
5. F. L. Singer and Pytel, Strength of Material, Harper and Row publication

List of Experiment:

1. To Study The Universal Testing Machine (U.T.M.)
2. To perform tensile test on Universal Testing Machine.
3. To determine Impact strength of steel by Izod test.
4. To determine Impact strength of steel by Charpy test.
5. To determine Hardness of Mild Steel (Rockwell Hardness Test).
6. To determine Hardness of Mild Steel (Brinell Hardness Test).
7. To determine Hardness of Mild Steel (Vicker's Hardness Test).
8. To determine Modulus of rigidity by torsion test of mild steel and aluminum rod.
9. To determine .Modulus of Elasticity of different materials of beam simply supported at ends.
10. To perform Shear test on Mild Steel.

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PCC-ME304	**Thermodynamics**	**2L:1T:2P (05hrs)**	**Credits:04**

Pre requisite(s): Nil

Course Objective's:

- Apply conservation principles to evaluate the performance of thermodynamics systems and cycles.
- Analyze processes and cycles using the second law of thermodynamics to determine maximum efficiency and coefficient of performance.
- Evaluate thermodynamic properties of pure substances.

Course Content:

Module 1 **(08 hrs)**

Basic Concepts & First Law of Thermodynamics: Thermodynamics, Property, Equilibrium, State, Process, Cycle, Zeroth law of thermodynamics statement and significance, Heat and work transfer. First law of thermodynamics- Statement of first law of thermodynamics, first law applied to closed system, first law applied to a closed system undergoing a cycle, processes analysis of closed system, flow process, flow energy, steady flow process, Relations for flow processes, limitations of first law of thermodynamics.

Module 2 **(09 hrs)**

Second Law of Thermodynamics: heat engine, heat reservoir, Refrigerator, heat pump, COP, Available energy, Carnot's theorem, Carnot's cycle, efficiency of Carnot's cycle, statement of second law Reversible and irreversible processes, consequence of second law, Entropy, Entropy change for ideal gas, T-S diagrams, Availability and Irreversibility.

Module 3 **(08 hrs)**

Real & Ideal Gases: Deviation with ideal gas, Vander-wall's equation, evaluation of its constants, limitations of the equation. Generalized, compressibility chart, P-V-T surface of a Real gas, Thermodynamics relations T-ds Equations, Maxwell relations and their applications. Gibbs and Helmholtz functions.

Module 4 **(09 hrs)**

Pure Substance: Phase, Phase-transformations, formation of steam, properties of steam, PVT surface, HS,TS,PV,PH,TV diagram, processes of vapor measurement of dryness fraction, Use of steam table and Mollier chart with Numerical Problem.

Module 5 **(07 hrs)**

Air standard cycles: Carnot, Otto, Diesel, Dual cycles and there comparison with P-V And T-S Diagram, two stroke and four stroke engines, non reactive gas mixture, PVT relationship, mixture of ideal gases, properties of mixture of ideal gases, internal energy, Enthalpy and specific heat of gas mixtures, Enthalpy of gas- mixtures.

Course Outcomes:

After completion of this course, the students are able to:

1. Explain the concepts of thermodynamics and analyze the different applications of first law of thermodynamics.
2. Evaluate entropy change in wide range of processes and determine the reversibility or irreversibility of a process from such Calculation.

3. Understand the various thermodynamic Equation and their Significance
4. Evaluate various properties of a steam with the help of steam table and Mollier charts.
5. Compare the different types Air standard cycles and explain the behavior of Ideal and Real gases mixture.

List of Reference Book:

1. P. K. Nag; Engineering Thermodynamics;TMH
2. Van GJ; Thermodynamics; John Wylen
3. Cengel Y; Thermodynamics;TMH
4. Arora CP; Thermodynamics;TMH
5. Mahesh M Rathore; Thermodynamics;TMH
6. Thermal Engineering by R Yadav
7. Engineering Thermodynamics by Omkar Singh New Age International.

List of Experiment:

1. Study of Boiler terminology and their Classification.
2. Study of working Low Pressure Boilers with demonstrate model.
3. Verify Joule's Experiments on Mechanical Equivalent of Heat.
4. Study of Temperature Measuring devices.
5. To Calculate the dryness fraction of Steam using Combined separating Throttling calorimeter
6. Determine the COP of Simple Vapour Compression Refrigeration System.
7. Find the calorific value of fuel by using Bomb Calorimeter.
8. Study of valve timing diagram for two and four stroke engines.

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MC-3	**Energy & Environmental Engineering**	**2L;0T;0P**	**Credits: 00**

Course Objective's:
To provide an introduction to energy resources and an emphasis on alternative energy sources and their application. To study the interrelationship between the living organism and environment. To understand the transformation and degradation of organic pollutants in the environment

Course Content:

Module 1 **(06 Hrs)**

Energy: Introduction, conventional and non-conventional energy resources - coal, oil, gas, solar energy, wind energy, geothermal energy, Hydropower, Bio-energy, Nuclear energy. Energy survey in India. Current and future energy requirements in India and across the world including associated environmental problems.

Module 2 **(08 Hrs)**

Ecosystem and Biodiversity: Introduction of an ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, rivers, oceans), Biodiversity at global, national and local levels. Threats to bio diversity, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic andoption values; Endangered and endemic species of India. Conservation of biodiversity: In-Situ and Ex-Situ.

Module 3 **(08 Hrs)**

Air pollution and Water Pollution: Definition, Cause, effects and control measures of Air pollution; Mobile and stationary sources of air pollutants, effective stack height concept, CO, CO_2, H_2S, SO_x, NO_x emissions, and its control. Definition, Classification, Cause, effects and control measures of water pollution, Measurement of levels of pollution such as DO, BOD, COD.

Module 4 **(06 Hrs)**

E-Waste: Definition, Classification, Cause, effects and control measures of e-waste, global trade issues of e-waste, Recycling method of e-waste & its benefit.

Module 5 **(08 Hrs)**

Environment Impact & Protection Act Environment: Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness. Environmental Impact Assessment. Measuring environmental impacts and policies for the regulation of environmental impacts.

Course Outcome-

CO 1: Ability to understand basic concepts conventional and non-conventional energy resources.

CO2: Ability to understand Ecosystem& Biodiversity.
CO3: To provide knowledge about Air pollution & Water Pollution.
CO4: To provide knowledge & reuse of E-Waste.
CO5: Ability to understand basic concepts of Environment Impact & Protection Act.

Text/Reference Book-

1. Environmental Engineering - H.S. Peavy & D.R. Rowe-Mc Graw Hill Book Company, New Delhi
2. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
5. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards', Vol I and II, Enviro Media (R).