Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's
Sharad Institute of Technology College of Engineering
(An Autonomous Institute)
Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Syllabus of S. Y. (MECH)

Department of Mechanical Engineering

Semester: III and IV

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Department: Mechanical Engineering
Class: S. Y. B. Tech.

Rev: Course Structure/00/2020-21
Semester: III

Course Code	Course Typre	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
ME301	BSC	Engineering Mathematics-III	3	1	-	4	10	10	30	50	100	4
ME302	PCC	Thermal Engineering	3	-	-	3	10	10	30	50	100	3
ME303	PCC	Analysis of Mechanical Elements	3	-	-	3	10	10	30	50	100	3
ME304	ESC	Manufacturing Processes	3	-	-	3	10	10	30	50	100	3
ME305	PCC	Machine Drawing and CAD	3	-	-	3	10	10	30	50	100	3
ME306	PCC	Thermal Engineering Laboratory	-	-	2	2	15	15	-	20	50	1
ME307	PCC	Analysis of Mechanical Elements Laboratory	-	-	2	2	15	15	-	20	50	1
ME308	PCC	Machine Drawing and CAD Laboratory	-	-	4	4	15	15	-	20	50	2
ME309	ESC	Workshop Practice	-	-	2	2	15	15	-	20	50	1
MDC01	MC	Constitution of India	2	-	-	2	25	25	-	-	50	Audit
PRJ02	PROJ	Mini Project-II	-	-	2	2	25	25	-	-	50	Audit
HMS01	HSMC	Aptitude Skills-I	1	-	-	1	25	25	-	-	50	1
HMS02	HSMC	Language Skills-I	-	-	2	2	25	25	-	-	50	Audit
		Total	**18**	**1**	**14**	**33**	**210**	**210**	**150**	**330**	**900**	**22**

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Department: Mechanical Engineering **Rev:** Course Structure/00/2020-21

Class: S.Y. B. Tech. **Semester:** IV

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
ME401	BSC	Numerical Methods for Mechanical Engineers	3	-	-	3	10	10	30	50	100	3
ME402	PCC	Engineering Material Science	3	-	-	3	10	10	30	50	100	3
ME403	PEC	Elective-I	3	-	-	3	10	10	30	50	100	3
ME404	PCC	Kinematics of Machines	3	-	-	3	10	10	30	50	100	3
ME405	PCC	Fluid Mechanics	3	-	-	3	10	10	30	50	100	3
ME406	BSC	Numerical Methods for Mechanical Engineers Laboratory	-	-	2	2	15	15		20	50	1
ME407	PCC	Engineering Material Science Laboratory	-	-	2	2	15	15		20	50	1
ME408	PEC	Elective-I Laboratory	-	-	2	2	15	15		20	50	1
ME409	PCC	Kinematics of Machines Laboratory	-	-	2	2	15	15		20	50	1
ME410	PCC	Fluid Mechanics Laboratory	-	-	2	2	15	15		20	50	1
PRJ03	PROJ	Mini Project -III	-	-	2	2	25	25	-	-	50	1
MDC02	MC	Environmental Sciences	2		-	2	25	25	-	-	50	Audit
IFT01	PROJ	Industrial Training/ Field Training-I	-	-	-	-	25	25	--	--	50	Audit
HMS03	HSMC	Aptitude Skills-II	1	-	-	1	25	25	--	--	50	Audit
HMS04	HSMC	Language Skills-II		-	2	2	25	25	-	-	50	1
		Total	**18**	**-**	**14**	**32**	**250**	**250**	**150**	**350**	**1000**	**22**

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Elective-I :

ME403A. Renewable Energy Engineering.
ME403B. Industrial Product Design
ME403C. CNC Machines
ME403D. Control Engineering
ME403E. Material Management

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Engineering Mathematics-III

ME301	BSC	Engineering Mathematics-III	3-1-0	4 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 1 hr/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Mathematics-I and II

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

CO1	Apply the definition and properties of Laplace Transform to evaluate the integral and to find Laplace transform of elementary functions and special functions like periodic function, Dirac-delta function and unit step function.
CO2	Apply the knowledge of Laplace transformation to find solution of linear differentiation equations with constant coefficient.
CO3	Solve partial differential equations and use of separation of variable method to solve heat and Laplace equations.
CO4	Develop the concept of Fourier series expansion of different periodic functions so as to use them in harmonic analysis.
CO5	Solve problems related to Fourier transform and inverse Fourier transform.
CO6	Solve finite difference equation using Z- transform.

Course Contents:

Unit 1: Laplace Transform Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function	[8]
Unit 2: Inverse Laplace Transform Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for	[7]

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finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.	
Unit 3: Partial Differential Equations and Their Applications Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation ($\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$), and two dimensional heat flow equation (i.e. Laplace equation ; $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$)	[8]
Unit 4: Fourier series Definition, Euler's formulae, Conditions for a Fourier expansion, Functionshaving points of discontinuity, change of interval, expansions of odd andeven periodic functions and half range series	[7]
Unit 5: Fourier Transforms Fourier Transforms, Fourier Sine and Cosine Transforms, Complex form of Fourier Integral, Finite Fourier Sine and Cosine Transform	[6]
Unit 6: Z Transform Definition, properties of z transform, Z Transform of basic sequences, Z transform of some standard discrete function inverse Z transform	[6]
Text Books: 1. P. N. Wartikar and J. N. Wartikar, A Text Book of Applied Mathematics (Vol I and II), Pune, Vidyarthi Griha Prakashan, Pune. 2. N. P. Bali, A Text Book of Engineering Mathematics, Laxmi Publications, New Delhi.	
Reference Books: 1. C. R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, McGraw Hill Publishing Company Ltd. 2. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publications, New Delhi. 3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers. 4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons. 5. Peter O" Neil, A Text Book of Engineering Mathematics, Thomson Asia Pvt. Ltd., Singapore.	

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Thermal Engineering

ME302	PCC	Thermal Engineering	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Physics, Engineering Chemistry, Basic Mechanical Engineering

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

CO1	Apply various laws of thermodynamics to various processes and real systems
CO2	Learn the concept of steam formation and apply it to solve engineering problems
CO3	Explain various vapor power cycles and its representation
CO4	Illustrate various types of boilers along with mounting and accessories
CO5	Explain the working principles of steam turbines and its performance
CO6	Explain the working principles of gas turbines and its performance

Course Contents:

Unit 1: Fundamental of thermodynamics and laws of thermodynamics Review of basic concepts of thermodynamics, properties of pure substances - First law applied to control mass, control volumes. First law of thermodynamics steady flow energy equation - applications of SFEE - uniform state, uniform flow. Second law statements - irreversible processes, Carnot theorem, Clausius Inequality — entropy, entropy change for pure substances – T-S diagram, entropy change applied to control mass, control volume-availability and irreversibility	[6]
Unit 2: Properties of Pure substances and Ideal Gas Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-v, T-s and Mollier diagram for steam, Dryness fraction and its determination, Study of steam calorimeters, Work and heat transfer, Properties of Pure substances, Gas law, Ideal Gas constant and Universal Gas constant, Ideal gas processes	[6]
Unit 3: Vapour Power Cycles and Thermodynamics relations Carnot Cycle and limitations, Rankine cycle - Effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Air standard power cycles, Assumptions regarding air standard cycles, Otto, Diesel, dual, Stirling and Brayton cycles, Maxwell relations - Clapeyron equation.	[6]

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Unit 4: Steam Generators Types and classification- low pressure fire and water tube boilers-mountings and its accessories-performance testing of boilers-equivalent evaporation-boiler efficiency-boiler trial and heat balance sheet – criteria for selection of a boiler. High pressure boilers introduction, introduction of steam condensers and cooling towers.	[6]
Unit 5: Steam Turbines Principles of impulse, reaction and impulse-reaction turbines-compounding-velocity diagrams for simple and multistage turbines-work done on turbine blades and efficiencies-losses in steam turbines, governing of steam turbines, compounding of turbine, expansion of steam through nozzle, effect of friction – super saturated flow.	[6]
Unit 6: Gas Turbine Open and closed gas turbines- ideal and actual cycles- compressor and turbine efficiency-effect of operating variables on thermal efficiency and work out put-work ratio-types of combustion of chambers combustion efficiency –methods to improve performance-inter cooling reheating and regeneration.	[6]

Text Books:

1. P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill, New Delhi, 3rd Edition, 2005.
2. Y. A. Cengel, M. A. Boles, "Thermodynamics - An Engineering Approach", Tata McGraw Hill, 5th edition, 2006
3. P. L Ballaney, "Thermal Engineering", Khanna Publication, 5th Edition, 2005.
4. R. K.Rajput, Thermodynamics
5. Engineering Thermodynamics by C P Arora.
6. Domkundwar, A., "A Course in Thermal Engineering", Dhanpat Rai and Co., New Delhi, 2011

Reference Books:

1. Thermodynamics, Holman, McGraw Hill.
2. Kumar and Vasandani, Thermal Engineering, Metropolitan Book Co,, Delhi,
3. Engineering Thermodynamics, Gupta and Prakash, Nemichand and Sons Hydraulic Machines by V.P. Vasantdani
4. Mathur and Mehta, Thermal Engineering, Jain Bros. Publishers, Delhi

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Analysis of Mechanical Elements

ME303	PCC	Analysis of Mechanical Elements	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Mechanics, Engineering Mathematics, Engineering Physics

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

CO1	Explain various types of loading and stresses induced in components.
CO2	Develop SFD and BMD for different types of loads and support conditions.
CO3	Analyze bending and shear stresses induced in mechanical components.
CO4	Analyze deflection in beams by Double integration method, Area moment method.
CO5	Analyze principal stresses and strains by analytical and graphical method.
CO6	Analyze buckling and bending phenomena in column and beam.

Course Contents:

Unit 1: Review of Stress, Strain and Elastic Constants Concept of Stress and Strain, (Linear, Lateral, Shear and Volumetric), Hooke's Law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Stress-strain diagram for ductile and brittle material, Factor of safety, Working stress, Normal and shear stresses, Thermal stresses and strains . Concept, Numerical problems.	[6]
Unit 2: Bending Moment and Shear Force in Mechanical Elements Introduction, Types of beams, Loads and Reactions, Shear forces and bending moments, Rate of loading, Sign conventions, Relationship between shear force and bending moments, Shear force and bending moment diagrams subjected to concentrated loads, uniform distributed load (UDL) for different types of beams (UVL not included).	[6]
Unit 3: Stresses in Mechanical Elements **Bending Stresses:** Symmetric pure bending of beams, Flexure formula, moment of resistance of cross-sections, Simple built-up section, Design of rectangular and circular (solid and hollow) sections; L, I and T sections. **Shear Stresses**: Distribution of shear stresses in beams of various commonly used sections such as circular. I, T, and angles.	[6]
Unit 4: Deflection of Mechanical Elements Concept of deflection, Slope and deflection by double integration method (Macauley's method).	[6]

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Slope and deflection for simply supported, cantilever and statically determinate elements	
Unit 5: Principal Stresses and Strains Normal and shear stresses on any oblique planes, Concept of Principal planes, Derivation of expression for Principal stresses and maximum shear stress, Positions of principal planes and planes of maximum shear, Graphical solutions using Mohrs circle of stresses, Combined effect of shear and bending in Beam, Theories of elastic failure (Without derivation).	[6]
Unit 6: Analysis of Columns and Struts Introduction, Euler's theory on columns, Effective length, Slenderness ratio, Short and long columns, Radius of gyration, Buckling load, Assumptions, Derivation of Euler's Buckling load for different end conditions, Limitations of Euler's theory, Rankine's formula. Numerical problems.	[6]

Text Books:

1. Strength of Materials, S. Ramamruthum, Dhanpat Rai and Sons, New Delhi.
2. Strength of Materials, R. K. Bansal, Laxmi Publication, 4th Edition.
3. Strength of Materials, Khurmi Gupta, S. Chand Publication.
4. Strength of Materials, R.K. Rajput, S. Chad Publication
5. Mechanics of structure, S.B Junnerkar, Charotar Publication House
6. Strength of Materials, S. S. Bhavikatti, Vikas Publication House
7. Strength of Materials, Timoshenko and Young, CBS Publication
8. Mechanics of Materials, S. S. Ratan, Tata McGraw Hill Publication, 2009
9. Strength of Materials, B. K. Sarkar, McGraw Hill Publication, 2003

Reference Books:

1. Strength of Materials, Beer and Johnson, CBS Publication
2. Strength of Materials, G.H. Rider, Mac Millan India Ltd
3. Strength of Materials, Nag and Chanda, Willey India Publication
4. Advanced Mechanics of Materials, Boresi, Willey India Publication
5. Strength of Materials, Den Hartong, McGraw Hill Publication

Manufacturing Processes

ME304	ESC	Manufacturing Processes	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Mechanical Engineering, Work shop practice I and II

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

1	Enlist and Classify manufacturing processes, machine tools, cutting tool materials, Plastic Materials
2	Explain basic casting process, operations and their types etc
3	Explain different types of furnaces, melting and pouring practices, Mechanization and Modernizations offoundriesetc.
4	Describe types of plastics, its manufacturing, basic welding process and various types
5	Discuss basic information of lathe, various operations involved, different types and their working.
6	Explain information of drilling ,boring machine and their operation involved different types and their working

Course Contents:

Unit 1: Introduction to Manufacturing Processes, Machine Tools and Cutting Tool Materials Classification of manufacturing processes, machine tools and cutting tool materials and their advantages, applications, limitations etc. Metal casting: Importance of casting, advantages, disadvantages and limitations of casting processes. Introduction and types of patterns, core boxes. Materials used and selection criteria for pattern, pattern allowances and colour codes used	[6]
Unit 2: Fundamentals of Metal Casting Moulding and core processes: types of sands used in moulding and core making, their properties. Sand is moulding types such as Green sand Moulding, shell Moulding, CO_2 Moulding, Investment casting. Equipments and tools used for moulding and core making. Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics. Introduction to permanent mould casting processes such as Continuous casting, Gravity die casting, pressure die-casting, Centrifugal casting, Vacuum die casting, Squeeze casting, etc. Expendable mould casting such as shell mould casting, green sand casting , dry	[6]

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sand casting, lost foam casting investment casing etc.	
Unit 3: Melting, Pouring and Modernization, Mechanization in Metal Casting Types of melting furnaces, Cupola furnace, oil/gas fired furnaces, crucible furnaces, Electrical furnaces, Rotary furnaces, etc.Furnace selection criteria their applications and melting practice on different furnaces. Metal pouring equipments, Cleaning-fettling of castings. Casting defects, their causes and remedies. Modernization, mechanization, use of computers in foundries and layout of foundry.	[6]
Unit 4: Plastic Working and Welding Processes Fabrication of plastics: Thermosetting and thermoplastic materials, comparison with other materials, their properties and applications. Shaping of plastics: casting, blow moulding, compression moulding, transfer moulding, injection moulding, extrusion, thermoforming, rotational moulding, foam moulding and calendaring etc. machining of plastics. Welding Processes: Overview and classification of welding processes: Oxyfuel gas welding such as oxyacetylene and pressure gas welding, arc welding such as shielded metal arc welding, gas metal arc welding, submerged arc welding, plasma arc welding, resistance welding such as spot, seam and projection welding	[6]
Unit 5: Machine Tools used in Manufacturing Technology-I Lathe: Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations. Capstan, turret lathe and automats: Principle parts, working, comparison with centre lathe,turret indexing mechanism, bar feeding mechanism, turret tool holders. Introduction to automats	[6]
Unit 6: Machine Tools used in Manufacturing Technology –II Drilling and Boring machines: Classifications, construction and working of Radial drilling machine, various operations on drilling machines. Horizontal and vertical boring machine, boring tools and bars used, Jig boring machine. Shaping and planning machines: Crank shaper, hydraulic shaper, Table feed mechanism, various operations on shaper. Standard double housing planner, table drive and feed mechanism, various operations on planner.	[6]

Textbook:

1. P. C. Sharma, A Textbook of Production Technology (Manufacturing Processes), S. Chand and Company, 2006.
2. P. L. Jain, Principles of Foundry Technology, Tata McGraw-Hill, New Delhi, 2nd Edition, 2006.
3. P. N. Rao, "Manufacturing Technology- Foundry, Forming and Welding", Vol.-I, Tata McGraw-Hill, 3rd edition, 2009.

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Reference Book

1. George E. Dieter, "Mechanical Metallurgy", Tata Mc Graw Hill Publication, Si Metric Edition, 3rd Revised edition, 2013
2. E. Paul DeGarmo, J.T. Black, Ronald A. Kosher, "Materials and Processes in Manufacturing", PHI Publication, 8th Edition, 1997.
3. Steve F. Krar, Mario Rapisarda, Albert F. Check, "Machine Tools and Manufacturing

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Machine Drawing and CAD

MECH305	PCC	Machine Drawing and CAD	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Graphics

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

CO1	Use of BIS conventions and sketch the various machine components
CO2	Construct sectional orthographic view from given isometric view.
CO3	Develop auxiliary view of an object from given views.
CO4	Construct the curve of intersection of two solids.
CO5	Show tolerances and level of surface finish on production drawings
CO6	Develop assembly view from details of given component and vice versa.

Course Contents:

Unit 1: BIS convention of machine elements and free hand sketches Conventional representation of engineering materials, BIS conventions for sectioning, Types of threads profiles, Internal and external threads, Types gears and gearings, pipe joints, welded joints. Importance of sketching and entering proportionate dimensions on sketches, Study of simple machine elements and components such as screwed fasteners, shaft couplings, pipe joints, riveted and welded joints, bearings, gears, etc.	[6]
Unit 2: Sectional Views Types of sections-Full section, half section, off-set section, guidelines for hatching, examples on full and half sections of machine elements, Introduction to Computer Aided Design and Drafting, Advantaged of CAD, study of preliminary AutoCAD commands like drawing. Study of basic Auto-CAD editing, dimensioning and viewing commands.	[6]
Unit 3: Auxiliary Projection Projection on auxiliary vertical and horizontal plane, Auxiliary projection of simple machine components.	[6]
Unit 4: Interpenetration of Surfaces (Emphasis on Applied Cases) Line or curve of intersection of two penetrating cylinders, Cone and cylinder, prism and a cylinder, cone and prism, Forged ends, pyramids and prism etc.	[6]

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Unit 5: Geometrical Dimensioning and Tolerances Limits, fits and tolerances system and its significance. Definitions, Types, Recommendations and selections, Tolerances of form and position, surface finish symbols as per BIS, Selection and entering of all these symbols with reference to details and assembly drawings, Tolerancing an individual dimensions of details drawing, surface roughness and surface roughness symbols, reading the blue prints.	[6]
Unit 6: Drawing of Assembly and Details: Part drawing of standard machine components such as valves, components of various machine tools, pumps, shaft couplings, joints, pipe fittings, engine parts, etc. Types of production drawings, size, shape and description. Use of limits, fits, tolerances and surface finish symbols on detail and assembly drawing, Introduction of 3D commands and views in AutoCAD	[6]

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, Anand, India.
2. N. D. Bhatt, Machine Drawing, Charotar Publishing House, Anand, India
3. Ajeet Sing, Working with AutoCAD 2000, Tata McGraw Hill, New Delhi.
4. George Omura, ABC of AutoLISP, BPB Publications, New Delhi.
5. P.S. Gill, Machine Drawing., S.K. Kataria and Sons, Delhi, 7th Edition,2008
6. Production Drawing, Narayana, Kannaiah and VenkataReddv, New Age International.2nd Edition, 2002

Reference Books:

1. Narayana, Kannaiah, Reddy, Machine Drawing, New Age International Publishers.
2. AutoCAD and Auto LISP manuals from Autodesk Corp. U.S.A.
3. IS Code: SP 46-1988, Standard Drawing Practices for Engineering Institutes.
4. Engineering Drawing, with an Introduction to AutoCAD, Dhananjay A. Jolhe, Tata McGraw Hill ,2010

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Thermal Engineering Laboratory

ME306	PCC	Thermal Engineering Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Pre-Requisites: NA

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

CO1	Evaluate various parameters like calorific value, dryness fraction etc.
CO2	Perform experiments on boiler, nozzle, condenser etc.
CO3	Analyze flue gases using emission measuring instruments

The Thermal laboratory consists of any 7 experiments .from the following:

1. Determination of calorific value by using Bomb calorimeter.
2. Measurement of dryness fraction of steam using separating and throttling calorimeter.
3. Flue gas analysis using emission measuring instruments
4. Trial on convergent/convergent-divergent type nozzle
5. Performance evaluation of surface condenser.
6. Trial on boiler
7. Study thermal power plant.
8. Industrial Visit to thermal power plant/Thermal Industries.

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Analysis of Mechanical Engineering Laboratory

ME307	PCC	Analysis of Mechanical Engineering Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Pre-Requisites: NA

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

CO1	Explain various types of loading and stresses induced in components.
CO2	Develop SFD and BMD for different types of loads and support conditions.
CO3	Analyze bending and shear stresses induced in mechanical components.

The Analysis of Mechanical Elements Laboratory consists of list of experiment as follows

1. Tensile test for Ductile and Brittle Material
2. Compression test of Mild Steel, Cast iron.
3. Torsion test on Mild Steel circular sections
4. Bending Test on Wood Material
5. Shear Test on Mild steel.
6. Strain Measurement in stress analysis by using Photoelasticity
7. Thermal stress measurement
8. Analyze the stress and strain for different loading condition in ANSYS.

Text Books:

1. Strength of Materials, S. Ramamruthum, Dhanpat Rai and Sons, New Delhi.
2. Strength of Materials, R. K. Bansal, Laxmi Publication, 4th Edition.

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3. Strength of Materials, Khurmi Gupta, S. Chand Publication. 4. Strength of Materials, R.K. Rajput, S. Chad Publication 5. Mechanics of structure, S.B Junnerkar, Charotar Publication House 6. Strength of Materials, S. S. Bhavikatti, Vikas Publication House 7. Strength of Materials, Timoshenko and Young, CBS Publication 8. Mechanics of Materials, S. S. Ratan, Tata McGraw Hill Publication, 2009 9. Strength of Materials, B. K. Sarkar, McGraw Hill Publication, 2003	
Reference Books: 1. Strength of Materials, Beer and Johnson, CBS Publication 2. Strength of Materials, G.H. Rider,Mac Millan India Ltd 3. Strength of Materials, Nag and Chanda, Willey India Publication 4. Advanced Mechanics of Materials, Boresi, Willey India Publication 5. Strength of Materials, Den Hartong, McGraw Hill Publication	

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Machine Drawing and CAD Laboratory

ME 308	PCC	Machine Drawing and CAD Laboratory	0-0-4	2 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 4 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Pre-Requisites: Engineering Graphics

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

CO1	Draw Conventional representation of standard machine components, welds, material etc.
CO2	Draw auxiliary projection of given object
CO3	Draw curves of intersection for intersecting solids
CO4	Construct an assembly drawing of given machine parts.
CO5	Make use of various Auto-CAD commands to developsectional view and assembly drawing of an object.
CO6	Make use of various Auto-CAD commands to construct3-D model.

The Machine Drawing and CAD Laboratory consists of list of experiment as follows

1. One full imperial drawing sheet on BIS conventions, free hand sketches consisting the drawing/ sketches of representation of standard components, symbols of pipe joints, weld joints, rivet joint etc.
2. Sheet based on auxiliary projection
3. Sheet Based on interpenetration of solids
4. One full imperial drawing sheets, one consisting of assembly and the other consisting of details of any one standard component such as valves, components of various machine tools, pumps, joints, engine parts, etc.
5. Draw orthographic sectional view of machine components by using AutoCAD.
6. Draw assembly using AutoCAD.
7. Draw 3-D model of one simple machine component.

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Workshop Practice

ME309	ESC	Workshop Practice	0-0-2	1 Credits

Teaching Scheme:	Examination Scheme:
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Pre-Requisites: -

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

CO1	Demonstrate Casting simulation software and CNC Turning
CO2	Inspect various properties of moulding sand
CO3	Perform wood and metal working operations

The Workshop Practice Laboratory consists of list of experiment as follows

Term Work:

1. Manufacturing Process Laboratory **A. Carpentry shop:** one Job of Pattern Making **[Location: Workshop-II]** **B. Sand Testing Laboratory [Location: Workshop-II]** a. Preparation of sand for mould and core making with demonstration of small components b. Tensile, Compressive and shear strength of moulding sand c. Permeability test for moulding sand d. Moisture content test for moulding sand e. Hardness test (mould/core) [Green and Dry] f. Sand Grain Size analysis (Grain Fineness No. on Sieve Shaker apparatus) g. Demonstration of Casting Simulation Software **2. Simple turning Job on Lathe Machine and Demonstration on CNC turning center [Location: Workshop I]** **3. Reports on industrial visits (min. Two) to ferrous and non-ferrous foundries, plastic industries**	[6] [10] [08]
Textbooks: 1. P.N.Rao, Manufacturing Technology- Foundry, Forming and Welding, Vol. I Tata McGraw-Hill, Third edition, 2009. 2. P.C.Sharma, A Textbook of Production Technology (Manufacturing processes),S. Chand co, 2006.	

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3. S. K. Hajra Choudhury, Workshop Technology – Vol II [Machine Tools], , Media Promoters and Publishers Pvt. Ltd. Mumbai, Tenth edition, reprint 2001.	
References: 1. George E. Dieter, Mechanical Metallurgy, McGraw Hill Book Company, Printed in Singapore, ISBN : 9780070168930, Pub. Date: 23-08-10 2. W.A.J. Chapman, Workshop Technology, CBS Publishing and Distributors, Delhi.Vol.I,5th Edition, 2001	

Constitution of India

MDC01	MC	Constitution of India	2-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs./week Practical:	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Pre-Requisites: -

Course Outcomes: At the end of the course students will be able to

CO1	Define the meaning and features of Indian constitution.
CO2	Interpret right to life and fundamental rights to certain freedom under article 19 and 21.
CO3	Outline the federal structure of power and directive principles of state policy.

Course Contents:

Unit 1: Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India	[4]
Unit 2: Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights , The scheme of the Fundamental Duties and its legal status	[4]
Unit 3: The Directive Principles of State Policy – Its importance and implementation , Federal structure and distribution of legislative and financial powers between the Union and the States , Parliamentary Form of Government in India – The constitution powers and status of the President of India	[4]
Unit 4: Amendment of the Constitutional Powers and Procedure , The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency	[4]
Unit 5: Local Self Government – Constitutional Scheme in India , Scheme of the Fundamental Right to Equality	[4]
Unit 6: Scheme of the Fundamental Right to certain Freedom under Article 19 , Scope of the Right to Life and Personal Liberty under Article 2	[4]

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Books:

1. Constitution of India Published by Government of India Ministry of Law and Justice (Legislative Department), 2020
2. Textbook on The Constitution of India by S R Bhansali
3. Constitution of India by Bakshi P M,January 2014

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Mini Project II

PRJ02	PROJ	Mini Project II	0-0-2	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Pre-Requisites: NA

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

CO1	Identify the problems related to technical, social importance.
CO2	Convert open-ended problem statements into the statement of work
CO3	Identify the literature gap with the help of available literature and survey
CO4	Inculcate problem-solving skills and critically analyze the options available to solve the problem.
CO5	Conceive the importance of documentation and report writing

An engineering graduate must pay attention to societal concerns to alleviate some of the real-life societal challenges by delivering reasonable technology solutions. The Mini Project concept is based on the same theme. The Mini Project attempts to discover societal problems and develop answers utilizing science and technology for the betterment of society or human life. This will assist students in understanding the product/project development process, best practices and encouraging their creativity to tackle real-world problems. While developing the application/product, students will learn effective team building, designing, budgeting, planning, engineering skills and processes, and safety norms and standards. Students will recognize the need for documentation and professional ethics.

Guidelines

1. Every student shall undertake the Minor Project in semester III and continue for semester IV.
2. A group of a minimum of 3 and a maximum of 5 students shall be allotted for each minor project.

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3. The students have to identify the problem by a discussion with various stakeholders, site visits, expertopinions and various research articles in consultation with the project guide.
4. Collect sufficient data and survey to establish the criticality of the problem to be solved.
5. Apply various tools for project planning and design.
6. Critically analyze various solutions/techniques to solve real-world problems.
7. Select and justify one of the solutions identified based on the feasibility, affordability, ease of use and environmental concern.
8. Learn and apply standards of engineering ethics and professional behavior

The committee of senior faculty members and a guide will be appointed to monitor the progress and continuous evaluation of each project. The assessment shall be done jointly by the guide and committee members.

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Aptitude Skills-I

HMS01	HSMC	Aptitude Skills- I	1-0-0	1 Credit

Teaching Scheme:	**Examination Scheme:**
Lecture: 01/week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks:

Pre-Requisites: Communication Skills

Group A

Aptitude (12Hrs) (Compulsory)

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

CO1	Understand speed math techniques to solve aptitude problems
CO2	Summarize number systems in detail.
CO3	Explain basic aptitude techniques related to Percentage, Average, Ratio Proportion and Fraction
CO4	Understand speed,time and distance concepts
CO5	Summarize the concepts of Business aptitude using basic aptitude
CO6	Solve the aptitude problems on Geometry and Venn Diagram

Course Contents:

Unit 1: Speed Math Techniques Multiplication, Squares, Square roots, Cubes, Cube roots	[1]
Unit 2: Number System Types of Number System, Last Digit Method, BODMAS Calculation, HCF and LCM, Progressions	[2]
Unit 3: Basic Aptitude Percentage, Average, Ratio and Proportion, Fraction, Partnership	[3]
Unit 4: Speed- Time- Distance Speed, Time, and Distance, Trains, Boats, Streams, Races	[2]
Unit 5: Business Aptitude Profit and Loss, Simple Interest, Compound Interest	[2]

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Unit 6: Geometry and Venn Diagram 2D and 3D Mensuration, Venn diagram	[2]

Text Books:

1. Arun Shrama - Quantitative aptitude for CAT.
2. RS Aggarwal, A Modern Approach to Verbal and Non-Verbal Reasoning,S.Chand Publisher; 2016 edition
3. RS Aggarwal, Quantitative Aptitude for Competitive Examinations, S.Chand Publisher; 2016 edition

Reference Books:

1. Fast Track Objective Arithmetic Paperback, by Rajesh Verma – 2018
2. Teach Yourself Quantitative Aptitude, Arun Sharma
3. The Pearson Guide To Quantitative Aptitude For Competitive Examination by Dinesh Khattar

Group B

Verbal Ability (12Hrs) (Compulsory)

Pre-Requisites: Communication Skills

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

CO1	Understand basic concepts of sentences and its structure
CO2	Understand the tenses and its use in daily life
CO3	Explain basic uses of speeches and voices in day to day life
CO4	Understand the use of modal verbs in sentence construction
CO5	Summarize various Phrases, Idioms and Proverbs
CO6	Summarize different words used in daily life

Course Contents:

Unit 1: English Grammar Structure and Types of Sentence, Conditional Sentences	[2]
Unit 2: Tenses Present tense, Past tense, Future tense, Use of Tenses in Sentence forming	[2]
Unit 3: Speeches and Voices	

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Direct and Indirect Speech, Active and Passive Voice	[2]
Unit 4: Modal Use of Modal verbs in Sentence Forming, Substitution and Elimination	[2]
Unit 5: Proverbs, Idioms and Phrases Use of Proverbs, Idioms and Phrases in Sentence Construction, Judgment and Inference Sentence	[2]
Unit 6: Vocabulary Vocabulary Building in Various Situations	[2]
Text Books: 1. Raymond Murphy, Essential English Grammar with Answers, Murphy 2. Objective General English by R.S. Aggarwal, S Chand Publishing; Revised edition (15 March 2017)	
Reference Books: 1. Rao N, D, V, Prasada, Wren and amp; Martin High School English Grammar and Composition Book, S Chand Publishing, 2017 Murphy, Intermediate English Grammar with Answers, Cambridge University Press;Second edition	

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Language Skills-I

HMS02	HSMC	Language Skills- I	0-0-2	Audit

Teaching Scheme:	**Examination Scheme:**
Practical: 02/week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks:

Pre-Requisites: Communication Skills

Languages (Any One)

C Programming (Technical Language) (24Hrs)

Syllabus for C Programming

Course Objectives:

This course provides an opportunity to enhance acquisition of the fundamental elements of the C programming language. Emphasis is on the progressive development of basic programming syntaxes and essentials used in C programming

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

CO1	Explain fundamentals and essentials of C programming.
CO2	Illustrate Types, Operators and Expressions.
CO3	Make use of Decision Making and Looping Statements
CO4	Make use of Arrays in C programming.

Unit 1: Basics of C Editing, Compiling, Error Checking, executing, testing and debugging of Programs, Flowcharts, Algorithms, Structure of C Program	[6]
Unit 2: Types, Operators and Expressions Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.	[6]
Unit 3: Decision Making and Looping Statements Statements and Blocks. If-else, else-if switch Loops while and for, do-while break and continue go to and Labels	[6]
Unit 4: Arrays Initializing arrays, Initializing character arrays ,two dimensional and multidimensional arrays	[6]

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Text Books:

1. C Programming Absolute Beginner's Guide, Que Publishing; 3rd edition (22 August 2013)
2. C Programming Language 2nd Edition, Peasrson Publication

Reference Books:

1. C: The Complete Reference, McGraw Hill Education; 4th edition (1 July 2017)
2. C Programming in easy steps, 5th Edition, In Easy Steps Limited
3. The C Programming Language, Second Edition, By Pearson Education India (1 January 2015)

Japanese Language Course I (24Hrs)

Course Objectives:

This course is designed to introduce students to the everyday language of Japan. Lessons will be organized around natural conversational topics, leading students from fundamental aspects of grammar to readings in simple texts.

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

1	Explain the history and scripts used in Japanese
2	Translate simple English words into Japanese
3	Express themselves by using simple sentences and responses to questions.
4	Demonstrate Japanese scripts through oral and written communication.

Course Contents:

Unit 1: Introduction Brief history of Japan, Japanese Language, Introduction of three scripts in Japanese, viz. Hiragana, Katakana, and Kanji, Days of the week, Basic Numerals, and months of the year,	[6]
Unit 2: Simple Word forming Demonstratives in Japanese, Writing simple words in Hiragana, Writing all types of words, and simple sentences in Hiragana, Verbs in Japanese,	[6]
Unit 3: Simple sentence forming Introduction of Katakana, Formation of simple sentences involving asking and answering questions, Basic Conversational skills. Asking and answering questions based on the topics studied, Introduction of few simple Kanji, and their use in sentences based on the pattern "---ni--- gaarimasu"	[6]
Unit 4: Simple interactions Translations from, and into Japanese, Reading an unseen paragraph, and answering questions based thereon, General revision	[6]

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Text Book:

1. NihongoShoho I (Japan Foundation Publ.)
2. GENKI I: An Integrated Course in Elementary Japanese (English and Japanese Edition)
3. Japanese for Busy People I: Kana Version (Japanese for Busy People Series) 3rd Edition

Reference Book:

1. Minna No Nihongo I (3A Corporation, Japan) Japanese from Zero! 1: Proven Techniques to Learn Japanese for Students and Professionals 6th Edition by George Trombl

Semester IV

Numerical Methods for Mechanical Engineers

ME401	BSC	Numerical Methods for Mechanical Engineers	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Mathematics, Engineering Mechanics

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

1	Solve system of equations by using various numerical technique.
2	Solve linear equation by using various numerical technique.
3	Develop basic mathematical equation for regression curve fitting
4	Determine differentiationand integration by using numerical methods
5	Solve ordinary differential equation using various methods
6	Solve partial differential equation by using different numerical technique.

Course Contents:

Unit 1: Roots of Equations **a) Error**-round-off,approximate and true error, truncation error, error propagation, importance of errors in computer programming. **b) Bracketing Methods -** Bisection Methods, False Position Method **c) Open Methods** – Newton-Rapson Method, Multiple Roots, System of non-linear Equations, Secant Method **d) Roots of polynomials** -Muller's Method	[6]
Unit 2: Linear algebraic equation Gauss Elimination Method - Naive Gauss Elimination method, Gauss-Jordan Method,Matrix Inversion -LU Decomposition, Iterative Method - Gauss Jacobi Method& Gauss Seidel Method	[6]
Unit 3: Curve fitting Least square regression-Linear regression, Polynomial Regression, fitting of exponential & logarithmic curve.	[6]

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Unit 4: Numerical Differentiation and Integration Trapezoidal rule, Simpson's ($1/3^{rd}$) rules , Simpson's ($3/8^{th}$) rules, Integration unequal segments, Romberg's Integration, Gauss Quadrature Method,Derivatives using newton's forward difference method, Derivatives using newton's Backward difference method and Derivatives using Stirling's central difference method	[6]
Unit 5: Interpolation Finite differences, Interpolation using newton's forward, backward and central formulae, Newton's divided difference Method, Lagrange's interpolation formula.	[6]
Unit 6: Partial Differential Equation Classification of second order Partial differential equations - Elliptic, Parabolic and Hyperbolic, Laplace's method, explicit method, implicit method,Crank Nicolson Method.	[6]

Text Books:

1. Steven C. Chapra, Numerical Methods for Engineers, Tata McGraw Hill Publications, New Delhi, 5th Edition, 2007.
2. B. S. Grewal, Numerical Methods in Engineering and Science with Programs in C and C++, Khanna Publications, New Delhi,7th Edition,2008.
3. Numerical Methods, E Balguruswamy Tata Mcgraw Hill Publication Company Ltd.,8th Edition,2002.
4. Numerical Methods, S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Scitech Publications India Pvt. Ltd. ,Chennai, 2nd Edition,2007.
5. Numerical Methods, Dr. V. N. Vedamurthy. Vikas Publication

Reference Books:

1. J.N. Kapoor, Mathematical Modeling, New Age Mumbai, first Edition,2005.
2. Kreyszig, Advanced Mathematics,Laurie Rosatone, USA, 2006.
3. Sigiresu S Rao, "Engineering Optimization,New Age International Publisher, 3rd Edition, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists, S. C. Chapra,Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2012.
5. Numerical Analysis Theory and Applications, R. L.Burden and J. D. Faires, Cengage Learning India Pvt. Ltd. ,New Delhi,1st Edition, 2005

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Engineering Material Science

ME402	PCC	Engineering Material Science	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Physics

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

CO1	Explain the importance of material science in mechanical engineering.
CO2	Explain the phase diagrams of various alloys w.r.t. compositions, properties and
CO3	Explain the techniques for performing destructive and non-destructive tests.
CO4	Explain the principles of heat treatment and heat treatment furnances.
CO5	Explain different heat treatment processes and its applications
CO6	Explain powder metallurgy techniques for producing components and various

Course Contents:

Unit 1: Metals and Alloy Systems Introduction to Metallic and Non-metallic materials and its classification (Metals/Alloys/Polymers/Composites/Ceramics), Types of bonds, Crystal structure (SC, BCC, FCC, HCP), Imperfections in crystals, Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring, Solid solutions and intermediate phases, Phases and Gibbs phase rule, Construction of equilibriumdiagrams from cooling curves, Isomorphous system (Solid Solution), Eutectic, Partial solubility Peritectic and Intermetallic Compounds, Lever arm principle.	[8]
Unit 2: Study of Iron Carbon Equilibrium Diagram With respect to typical compositions, Properties and Applications for the following alloys: a) Fe- Fe_3C equilibrium diagram - Ferrous alloys (Plain carbon steels, cast iron), b) Alloy steels- Free cutting steels, HSLA High Strength Low Alloy steels, Maraging steels. Creep resisting steels, Stainless steels- different types. Tool steels- types.	[6]
Unit 3: Study of Various Phase Diagrams a) Copper based alloys brasses Cu- Zn, Bronzes Cu- Sn, Cu- Be, Cu-Ni, b) Aluminum based alloys Al- Cu(Duralumin) - Al-Si (Modification), c) Ti (Ti-6Al-4V) Selection of materials and Specifications based on - IS, BS, SAE, AISI.	[4]
Unit 4: Principles of Heat Treatment a) Transformation of Pearlite into austenite upon heating, b) Transformation of austenite into Pearlite, Bainite and Martensite on cooling,	[6]

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c) TTT –Diagram - significance, CCT - Diagrams – significance, Effect of alloying elements on TTT diagram and its significance, d) Heat treatment furnaces and equipments, controlled atmosphere	
Unit 5: Heat Treatment Processes a) Heat Treatment of Steels: Annealing – Types-Full, Partial and Sub critical annealing (Various types) and purposes, Normalizing- Purposes; Hardening(Hardening types), Austempering and Martempering, Mechanism of quenching and Quenching media, Hardenability- Conceptand methods of determination of hardenability- Grossmans criticaldiameter method and Jominy end quench test, Tempering Types, Structuraltransformations during tempering, purposes of subzero treatment; Surfacehardening - Flame and Induction, Chemical heat treatments for casehardening - Carburizing, Nitriding, Cyaniding, Carbonitriding b) b) Heat treatment of Nonferrous Alloys: Annealing- Stress relief, Recrystallization and Process annealing; Precipitation hardening – Basic requirements, Stages, Common alloys c) Heat treatment defects and remedies.	[6]
Unit 6: Powder Metallurgy and Strengthening Mechanisms Advantages, Limitations and Applications of Powder Metallurgy, Powder manufacturing types- Mechanical, Physical, Chemical and Electro- Chemical, Mixing/ Blending- (Double cone and Y- Cone mixers) Compaction- types-Conventional, Isostatic, HERF, Powder rolling and extrusion, Sintering- Types, Liquid stage and solid stage sintering, Finishing operations: Sizing, Machining, Infiltration and Impregnation, Refinement of grain size, cold working/strain hardening,Solid solution strengthening, dispersion strengthening.	[6]
Text Books: 1. Material science and metallurgy for engineers, V.D. Kodgire, Everest Publishers Pune, 12th Edition. 2. Introduction to Physical Metallurgy, S. H. Avner, TMH publication, 2010. 3. Physical metallurgy, Vijendra Singh, Standard Publishers Delhi	
Reference Books: 1. Introduction to physical metallurgy, S. H. Avner, McGraw Hill Book Company Inc, Edition, 2nd , 1974. 2. Material science and engineering W. D. Callister, Wiley India Pvt. Ltd., 5th Edition. 3. Heat Treatments Principles and Practices", T. V. Rajan/ C.P. Sharma, Prentice Hall of India Pvt Ltd, New Delhi, 4. Engineering Metallurgy", R. A. Higgins, Viva Books Pvt. Ltd., New Delhi, 1st Ed.,1998.	

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Elective I

Renewable Energy Engineering

ME403A	PEC	Renewable Energy Engineering	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

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

CO1	Explain the different renewable energy sources
CO2	Elaborate working of solar collectors and solar applications
CO3	Design Solar Photovoltaic System
CO4	Elaborate working of other renewable energies such as wind, biomass
CO5	Classify different Renewable energy source
CO6	Estimate Energy Utilization through Energy Audit Case Study

Course Contents:

Unit 1: Introduction of Renewable Energy and Solar Radiations Renewable Energy resources, Estimation of renewable energy reserves in India, Solar energy, Spectral distribution, Solar geometry, Attenuation of solar radiation in Earth's atmosphere, Measurement of solar radiation, Properties of opaque and transparent surfaces	[6]
Unit 2: Solar Collectors and Solar Energy Applications **Flat Plate Solar Collectors**: Construction of collector, material, selection criteria for flat plate collectors, testing of collectors, Limitation of flat plate collectors, Introduction to ETC. **Concentrating type collectors**: Types of concentrators, advantages, paraboloid, parabolic trough, Heliostat concentrator, Selection of various materials used in concentrating systems, tracking. **Solar Energy Applications**: Air/Water heating, Space heating/cooling, solar drying, and solar still,	[6]

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Unit 3: Solar Photovoltaic System Operating Principle of Photovoltaic cell concepts, Photo-cell materials, Cell module array, Series and parallel connections, Maximum power point tracking, Design of standalone system with battery and AC or DC load (Descriptive Treatment), Applications	[6]
Unit 4: Wind Energy and Biomass Types of wind mills, Wind power availability, and wind power development in India. Evaluation of sites for bio-conversion and bio-mass, Bio-mass gasification with special reference to agricultural waste	[6]
Unit 5: Introduction to Other Renewable Energy Sources Tidal, Geo-thermal, OTEC; Mini/micro hydro-electric, Geo-thermal, Wave, Tidal System design, components and economics.	[6]
Unit 6: Energy Auditing Elements and concepts, Types of energy audits, Instruments used in energy auditing. Economic Analysis: Cash flows, Time value of money, Formulae relating present and future cash flows-single amount, uniform series	[6]
Texts books: 1. Chetansingh Solanki, Renewable Energy Technologies, Prentice Hall of India, 200	
References: 1. S. P. Sukhatme, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill Publications, New Delhi, 1992. 2. G. D. Rai, Solar Energy Utilization, Khanna Publisher, Delhi, 1992	

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Industrial Product Design

ME403B	PEC	Industrial Product Design	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

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

CO1	Demonstrate knowledge of integration of design aspects like product architecture, ergonomics, aesthetics, quality, safety, reliability and product data management.
CO2	Develop different alternative solutions for small sub problems and select most appropriate solution from the set of solutions.
CO3	Estimate cost of new product by considering various components of the costs and Explain importance of designing the product using design for X methodology.
CO4	Apply aesthetic and ergonomics considerations while designing controls, displays and user interfaces.
CO5	Describe basics of Product Architecture, Prototyping and Cost and Value Engineering. Select the Standard Ergonomics and Industry Safety parameters in Product Design.

Unit 1: Introduction Challenges of product development, Identify customer needs, Successful product development, Quality aspect of product design, Market Research, Survey.	[6]
Unit 2: Product Development Process and Planning Innovation and Creativity in Product Design, Product Planning Processes, Product specifications: Process of setting specifications. (Concept Generation–Selection–Testing).	[6]
Unit 3: Product Architecture Product Architecture: Implication of architecture, Establishing the architecture, Related system level design issue, Product Data Management, Use of Computerized Data Management and `Process, Industrial Design : Overview. **Aesthetics:** Aesthetic Considerations, Visual Effects of Form and Colour in Product Design. **Ergonomics**: Ergonomics and product design and automated systems, Anthropomorphic	[6]

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data and its applications in ergonomic design	
Unit 4: Design for Manufacturing and Assembly **Tolerance, Design of Gauges, Design for Environment, Prototyping, Engineering Materials,** Concurrent Engineering, Product Costing, Value engineering.	[6]
Unit 5: Geometric Modeling Techniques Geometric modeling techniques- Wireframes, B-Rep, CSG and Hybrid modelers, Feature based, Parametric and Variation modeling, Virtual realism, computer animation, mechanical assembly and mass property calculations, CAD/CAM integration	[6]
Unit 6: Industrial Safety: An approach to Industrial Design - Elements of Design Structure for Industrial Design in engineering applications in manufacturing systems. Personal protective Equipment and Environment Control Prevention and specific safety measures for manufacturing and processing industry and chemical industry.	[6]

Text Books:

1. Product Design and Development,Karl T. Ulrich, Steven G. Eppinger; Irwin TataMcGraw Hill, 3rd Edition.
2. Product Design and Manufacturing,A.C. Chitale and R.C. Gupta, Prentice Hall ofIndia, 3rd Edition.
3. Product Design,Otto and Wood, Pearson education.
4. Human Factor Engineering, L P Singh ,Galgotia Publication Pvt. Ltd, 1st Edition.

Reference Books:

1. New Product Development, Tim Jones, Butterworth, Heinemann, Oxford, (1997).
2. Assembly Automation and Product Design,Geoffrey Boothroyd, Marcel Dekker, CRC Press.
3. Industrial Product Design,C W Flureshem.
4. Industrial Design for Engineers,Mayall W.H, London, Hiffee books Ltd.
5. Introduction to Ergonomics,R.C. Bridger, Tata McGraw Hill Publication.

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CNC Machines

ME403C	PEC	CNC Machines	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks
Tutorial:	Continuous Assessment 2: 10 Marks
Practical:	Mid Semester Exam: 30 Marks
	End Semester Exam: 50 Marks

Pre-Requisites:

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

CO1	Explain different CNC machines
CO2	Explain tooling for CNC machines
CO3	Explain CNC Programming
CO4	Explain Elements of CNC machines
CO5	Explain CNC turning centers
CO6	Explain CNC machining centers

Course Contents:

Unit 1: CNC Machines NC, CNC and DNC, Constructional features – Drives and control systems, Feedback devices – Interchangeable tooling system – Preset and qualified tools, ISO specification – Machining center – Turning center.CNC Programming:(Sample program in lathe and milling – Computer aided part programming – APT program – CAM package – Canned cycles – Programming.) Manual part programming	[6]
Unit 2: Tooling for CNC Machines Interchangeable tooling system, preset and qualified tools, coolant fed tooling system,modular fixturing, quick change tooling system, automatic head changers, DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding	[6]
Unit 3: CNC Programming Definition, importance of various positions like machine zero, home position, work piece zero, programmezero,NC part programming: part programming fundamentals, manual programming, NC coordinate system and axes, sequence number, preparatory functions, dimension words, speed word, feed word, tool word, miscellaneous functions	[6]

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Unit 4: Elements of CNC machines Types, working and importance of slide ways, re-circulating ball screw,devices (transducers, encoders),automatic tool changers (ATC), automatic pallet changers (APC), CNC tooling: tool presetting concept and importance, Qualified tools- definition, need and advantages, Tool holders – types and applications	[6]
Unit 5: CNC turning centers Types of CNC turning center., features of CNC turning center, axes nomenclature of CNC turning center, specification of CNC turning center, work holding devices – types, Working of CNC turning center, Applications of CNC turning center	[6]
Unit 6: CNC machining centers Types CNC machining center, features CNC machining center, axes nomenclature CNC machining center, specification CNC machining center, work holding devices – types, Working of CNC machining center, Applications of CNC machining center	[6]

Term Work:

1. Features and selection of CNC turning and milling centers.
2. Practice in part programming and operation of CNC turning machines, subroutine techniques and use of cycles.
3. Practice in part programming and operating a machining center, tool panning and selection of sequences of operations, tool setting on machine.
4. Pabla, B.S.; Adithan M., CNC Machines, New Age International, New Delhi, 2014.
5. Quesada, Robert, Computer Numerical Controlturning and machining centers, PHI Learning , New Delhi,2004
6. Sareen, Kuldeep, CAD/CAM" S.Chand, New Delhi, 2007.

Reference Books:

1. Vishal, S., Introduction to NC/CNC Machines, S.K.Kataria and Sons., New Delhi,2009
2. Rao,P N; Tiwari, N K; Kundra, T Computer Aided Manufaturing, Tata McGraw Hill, New Delhi,2014.

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Control Engineering

ME403D	PEC	Control Engineering	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Graphics, Machine Drawing.

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

CO1	Explain Mathematical Model
CO2	Explain Block Diagram Algebra
CO3	Explain Transient Response Analysis
CO4	Explain Stability and Root Locus Technique
CO5	Explain Frequency Response Analysis
CO6	Explain State Space Analysis

Course Contents:

Unit 1: Mathematical Model Introduction to automatic control: generalized control system, types, open loop and closed loop systems, advantages of automatic control systems, mathematical model of control system, mathematical model of control system: mechanical translational systems, rotational system, grounded chair representation, electrical elements, analogous systems, force	[6]
Unit 2: Block Diagram Algebra Transfer Functions definition, function, block representation of systems elements, reduction of block diagrams, Linearization of operating curves	[6]
Unit 3: Transient Response Analysis Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. Damping Ratio and Natural Frequency	[6]
Unit 4: Stability and Root Locus Technique Stability and Root Locus Technique: Routh's Stability Criteria, Significance of Root Locus,Construction of Root Loci, General Procedure, Effect of Poles and Zeros on the System Stability.	[6]
Unit 5: Frequency Response Analysis Frequency Response Analysis: Frequency Response Log Magnitude Plots and Phase	[6]

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angle Plots, Gain Margin, Phase Margin, Evaluation of Gain 'K', Polar Plots (No numerical), and Stability analysis.	
Unit 6: State Space Analysis: Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, System Representation, Direct, Parallel, Series and General Programming	[6]

Textbook/Reference Books:-

1. Control System Engineering: R Anandnatarajan, P. Ramesh Babu, SciTech Publi.
2. Control Systems: A. Anand Kumar, Prentice Hall Publi.Mortenson M. E., Geometric Modeling, John Wiley and sons, NY, 1985
3. Automatic Control Engineering: F.H. Raven (5th ed.), Tata McGraw Hill Publi..
4. Modern Control Systems: K Ogata, 3rd Ed, Prentice Hall Publi.
   Modern Control Engineering K. Ogata Pearson Education

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Material Management

ME403E	PEC	Material Management	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

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

CO1	Explain material management system (Understand)
CO2	Illustrate supply chain management (Understand)
CO3	Make use of material management linkages and elements of production processes
CO4	Classify cost involved in material management and store handling equipments (Analyze)

Course Contents:

Unit 1: Introduction to Materials Management: Meaning, definition, scope, and functions of Materials Management, Objectives, and Advantages of Materials Management. Interfaces of Materials Management: Internal and external interfaces. Organisation for Material Management	[6]
Unit 2: Supply Chain Management Concept, objectives of supply – production and distribution system, Role and Management of flow of material in supply chain management.	[6]
Unit 3: Material Management Linkages Linkages with other functional areas of Management i.e. Production, Accounting and Finance, Marketing, HRM, IT, TQM.A Brief discussion on the functions of each functional area of Management.	[6]
Unit 4: Elements of Production Processes Familiarity with broad categories of production processes used in industries. Commonly used machines and tools in industries.	[6]
Unit 5: Cost Involved in material management General discussion on concept of costs and cost classification, specific costs associated with Material Management.	[6]
Unit 6: Store Handling Equipment Advantages of using stores handling equipment, Types of handling equipment: manual and mechanical devices.	[6]

Text Books:

1. Dutta A.K., Materials Management: Procedures, Text and cases, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Gopalakrishnan, P. and Sundareson, M., Materials Management: An Integrated Approach,

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Prentice Hall of India Pvt. Ltd., New Delhi.
3. Varma, M.M., Essentials of Storekeeping and Purchasing, Sultan Chand and Sons, New Delhi.
4. Shah N.M. An Integrated concept of Materials Management, Indian Institute of Materials Management, Baroda Branch, Baroda

Reference Books:

1. Sharma S.C., Material Management and Materials Handling, Khanna Publishers, New Delhi.
2. Arnold, Champman and Ramakrishnan, Introduction to Materials Management 5th ed., 2007 Pearson Education, Inc.
3. Pooler Victor H. Purchasing and Supply Management, Creating the Vision, New York, Chapman and Hall, 1997.
4. Moore, J.M., Plant layout and Design, Macmillan New York.

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Kinematics of Machines

ME404	PCC	Kinematics of Machines	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Physics, Mathematics

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

CO1	Classify planer mechanism and determine the motion of mechanism.
CO2	Analyze graphically velocity and acceleration of planer mechanism using Instantaneous
CO3	Determine frictional torque in screw, pivot bearing, clutch and brake
CO4	Construct cam contour for given motion.
CO5	Evaluate effect of angle of contact, initial tension, coefficient of friction and slip on power transmission of belt.
CO6	Explain the basics of Gear, Gear Geometry, laws and types of gear profiles

Course Contents:

Unit 1: Fundamentals of Kinematics and Mechanisms Definition of link, pair, kinematics chain, inversionsInversions of single and double slider crank chain, kinematic diagrams of mechanisms,Equivalent linkage of mechanism, degree of freedom.Study of various mechanisms such as straight line mechanisms, pantograph, Geneva mechanismSteering gear mechanisms, and condition of correct steering,Hooke's joint. Ratio of driving velocities	[6]
Unit 2: Velocity and Acceleration Analysis Basics of velocity and acceleration analysis and its purposeVelocity and acceleration diagrams using relative velocity methodVelocity and acceleration diagrams using relative velocity methodCorioli's component of acceleration, Velocity and acceleration of slider crank mechanism byanalyticalmethodVelocity and acceleration of slider crank mechanism by Klein's construction.	[6]
Unit 3: Friction Dry friction, friction between nut and screw with different types of threads, Uniform wear theory and uniform pressure theory, Friction at pivot and collars, Friction circle and friction axis. Classification of Clutches, torque transmitting capacity of - plate clutch, cone clutch and centrifugal clutch, Classification of brakes, braking torque of - shoe brakes, internal shoe brake, disc brake	[6]
Unit 4: Cams and Followers Types of cams and followers, Analysis of motion, Jump and ramp of cam,	[6]

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Determination of cam profiles for a given follower motion, Circular arc cam, Tangent cam, Cycloidal cam.	
Unit 5: Belts and Dynamometers Types of belt and rope drives, calculation of length and power transmitted,Belt tension ratio Actual tension in a running belt, centrifugal and initial tension in beltSlip and creep of belt. Classification of dynamometers, Study of rope brake absorption dynamometer and belt transmission dynamometer	[6]
Unit 6: Toothed gearing Geometry of motion, Gear geometry,Types of gear profile- involute and cycloidal Theory of Spur, Helical and Spiral gearsInterference in involute tooth gears and methods for its preventionPath of contact, Contact ratioTypes of Gear trains - Simple, Compound, Reverted, Epicyclic gear train,Tabular method for finding the speeds of elements in gear train,Torques in gear train	[6]

Text Books:

1. S. S. Rattan, Theory of Machines, Tata McGraw Hill, New Delhi.
2. A. Ghosh, A. K. Malik, Theory of Mechanisms and Machines, Affiliated East-West Press Pvt. Ltd., New Delhi.
3. P.L.Ballany, Theory of Machines, Khanna Publication, New Delhi.
4. V.P. Singh, Theory of Machines, Dhanpat Rai and Sons.
5. Phakatkar, Theory of Machines I and II, Nirali Publication. Pune
6. Dr. R.K.Bansal, Theory of machines, Laxmi Publication.

Reference Books:

1. J. E. Shigely, J. J. Uicker, "Theory of Machines and Mechanisms", Tata McGraw Hill Publications, New York, International Student Edition, 1995.
2. Thomas Beven, "Theory of Machines", CBS Publishers and Distributors, Delhi.
3. Shigley, Theory of Machines and Mechanism, McGraw Hill, New York
4. G.S. Rao and R.V. Dukipatti, Theory of Machines and Mechanism, "New Age Int. Publications Ltd. New Delhi.
5. Shah and Jadhawani, Theory of Machines, Dhanpat Rai and Sons
6. Abdullah Shariff, Theory of Machines, McGraw Hill, New Delhi.

Fluid Mechanics

ME405	PCC	Fluid Mechanics	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment 1: 10 Marks Continuous Assessment 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Mechanics, Engineering Mathematics, Engineering Physics.

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

CO1	Explain various properties of fluids and their SI units and determine hydrostatic forces on the plane and curved surfaces and explain stability of floating bodies.
CO2	Classify various types of flows and determine velocity and acceleration of fluid
CO3	Apply Bernoulli's Equation to simple problems in Fluid mechanics.
CO4	Explain laminar and turbulent flows on flat plate and through pipes.
CO5	Calculate different losses in fluid flow through different arrangements of pipes.
CO6	Make use of Dimensional Analysis to simple problems in fluid mechanics and explain boundary layer, drag and lift.

Course Contents:

Unit 1: Fundamentals of Fluid Mechanics **Properties of Fluids**:- Definition of fluid, concept of continuum, Density, Specific Weight, Specific Gravity, Dynamic Viscosity, Kinematic Viscosity, Newton's law of viscosity, types of fluid, Rheological diagram, Surface Tension, Capillarity, Compressibility, Vapour pressure **Fluid Statics:** -Pascal's Law, Pressure at a point, Total Pressure and Centre of pressure for inclined flat plate, Buoyancy, metacenter and floatation.	[6]
Unit 2: Kinematics of Fluid Motion Eulerian and Langragian approach of fluid flow, total or material derivative for velocity field, Continuity equation, types of flows (One, two, three dimensional, steady unsteady, uniform, non-uniform, laminar, turbulent, compressible, incompressible, rotational, Irrotational) . Visualization of flow field (Stream, Path and Streak line), vorticity in two dimensional flow, stream function and velocity potential function	[6]
Unit 3: Fluid Dynamics Euler equation of motion, derivation of Bernoulli's equation along stream line , concept of HGL and THL or TEL, application of Bernoulli's equation to venture meter, Pitot tube, Submerged Orifices, Orifice meter, V-notch, Introduction to flow models- control	[6]

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volume and infinitesimally small element, Linear momentum Equation using differential Approach, Introduction to Navier – Stokes Equation	
Unit 4: Internal Flow 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.	[6]
Unit 5: Flow through Pipes Energy losses through pipe-Major and Minor losses, Darcy-Weisbach equation, pipes in series, pipes in parallel and concept of equivalent pipe, Moody's diagram, Siphons, Transmission of power.	[6]
Unit 6: Boundary Layer Theory and Forces on Immersed Body **Boundary Layer Theory**- Boundary layer thickness, its characteristics, laminar and turbulent Boundary layers, Displacement thickness, Momentum thickness, Energy thickness, separation, Boundary layer control **Forces on Immersed Bodies**: Lift and Drag, Drag on a flat plate and on aero foil.	[6]

Text Books:

1. Introduction to Fluid Mechanics- Fox, Pichard , McDonald- Wiley
2. Hydraulics and Fluid Mechanics, - Modi P. N. and Seth S. M -Standard Book House
3. Introduction to Fluid Mechanics- Fox, Pichard , McDonald- Wiley
4. Fluid Mechanics,- Dr. R.K. Bansal- Laxmi Publication (P) Ltd. New Delhi
5. Fluid Mechanics,- Cengel and Cimbla- TATA McGraw-Hill
6. Fluid Mechanics- White- TATA McGraw-Hill
7. "Mechanics of Fluid", Merle C. Potter, Prentis HallofIndia, New Delhi 2nd Edtion .

Reference Books:

1. Introduction to Fluid Mechanics-Edward Shaughnessy, Ira Katz James Schaffer-OXFORD University Press
2. Fluid Mechanics – Chaim Gutfinger David Pnueli-Cambridge University press.
3. Fluid Mechanics- Kundu, Cohen, Dowling- Elsevier India
4. "Fluid Mechanics and Machinery", C.S. Ojha, Oxford University Press.
5. "Fluid Mechanics", V.L. Streeter and E.B. Wylie, Tata McGraw Hill Pvt Ltd., NewDelhi,2ndEdition ,1997"

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Numerical Methods in Mechanical Engineers Laboratory

ME406	BSC	Numerical Methods in Mechanical Engineers Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

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

CO1	Construct programs in C++/ MATLAB to solve problem based on bisection and newton-raphson method
CO2	Develop programs in C++/ MATLAB to solve problem based on curve fitting & linear algeric equation.
CO3	Develop programs in C++/ MATLAB to solve problem based on Lagrange's interpolation and Numerical differentiation
CO4	Construct programs in C++/ MATLAB to solve problem based on Numerical integration and Partial differentiation equation.

The students are expected to solve the problems in mechanical engineering (In area like Thermal, Design, FEA, etc .) using following methods by choosing appropriate software from C , C++ ,MATLAB.

1. Program on bisection and false position method.
2. Program on newton-raphson method.
3. Program on Linear algebric equation.
4. Program on curve fitting.
5. Program on Lagrange's interpolation.
6. Program on Numerical differentiation.
7. Program on Numerical integration.
8. Program on Partial differentiation equation.

Text Books:

1. Steven C. Chapra, Numerical Methods for Engineers, Tata McGraw Hill Publications, New Delhi, 5th Edition, 2007.
2. B. S. Grewal, "Numerical Methods in Engineering and Science with Programs in C and C++", Khanna Publications, New Delhi, 7th Edition, 2008.

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3. Numerical Methods, E Balguruswamy Tata MegrawHill Publication Company Ltd.,8th Edition, 2002.
4. Numerical Methods, S. Arumugam,A. Thangapandi Isaac and A.Somasundaram, Scitech Publications India Pvt. Ltd., Chennai, 2nd Edition,2007.
5. "Numerical Methods", Dr. V. N. Vedamurthy. Vikas Publication.

Reference Books:

1. J.N. Kapoor, Mathematical Modeling,New Age Mumbai, first Edition,2005.
2. Kreyszig, Advanced Mathematics,Laurie Rosatone, USA, 2006.
3. Sigiresu S Rao, "Engineering Optimization", New Age International Publisher, 3rd Edition, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists, S. C. Chapra, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2012.
5. Numerical Analysis Theory and Applications,R. L. Burden and J. D. Faires, Cengage Learning India Pvt. Ltd., New Delhi,1st Edition,2005.

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Engineering Material Science Laboratory

ME407	PCC	Engineering Material Science Laboratory	0-0-2	1 Credit

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Pre-Requisites: None

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

CO1	Make use of hardness testing machine and Impact testing machine for measurement of hardness and hardenability and impact strength respectively.
CO2	Identify the surface cracks by using dye penetration test.
CO3	Develop specimen for microscopy.
CO4	Identify various materials by using spark test.
CO5	Demonstrate microstructure for various alloys.

List of Practicals/Experiments/Assignments

1. Study of Destructive Testing Methods.
2. Hardness testing (Rockwell and Brinell)
3. Impact testing (Izod and Charpy) of M.S, Brass and Al Alloy.
4. Study of various N.D.T. Techniques.
5. Macroscopic Examinations Spark Test.
6. Examination of microstructure of steels and Cast Irons.
7. Examination of microstructure of Non-ferrous alloys.
8. Study of heat treatment of steels (Annealing, Normalizing, Hardening on medium/ high carbon steels
9. Jominy End - Quench test for hardenability
10. Observation of various industrial heat treatments processes during industrial visits.

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Electives Laboratory

Renewable Energy Engineering Laboratory

ME408A	PEC	Renewable Energy Engineering Laboratory	0-0-2	1Credit

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

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

CO1	Outline characteristic curves of PV cell
CO2	Elaborate working of other renewable energies such as wind, biomass, solar PV
CO3	Demonstration of flow and temperature measuring instruments
CO4	Estimate energy utilization through energy audit case study

Term Work:

1. Demonstration and measurement of solar radiation. 2. Performance on PV Cell (I-V Charactrcristics curves) 3. Visit to Wind power plant with detailed report 4. Visit to Solar PV Power Generation Plant with detailed report 5. Energy Audit: Case study of an organization and report 6. Calculation of heat loss through radiation 7. Demonstration and measurement of air flow rate.	

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Industrial Product Design Laboratory

ME408B	PEC	Industrial Product Design Laboratory	0-0-2	1Credit

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

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

CO1	Demonstrate knowledge of integration of design aspects like product architecture, ergonomics, aesthetics, quality, safety, reliability and product data management.
CO2	Develop different alternative solutions for small sub problems and select most appropriate solution from the set of solutions.
CO3	Illustrate various creating and editing commands in 3D software.
CO4	Model machine parts using 3D software.
CO5	Generate Shape optimization of any mechanical component
CO6	Develop physical 3D mechanical structure using any one of the rapid prototyping

Term Work:

1. Case Study on any TWO (by a group, a group of Min.02 and Max. 04 students to be presented in front of all students) covering following points, a) Product Development Process / Planning. b) Product Architecture. c) Design for Manufacturing. d) Design for Assembly. e) Aesthetic and Ergonomic considerations in Product Design. f) Industrial Safety in Machine and Equipment Handling. g) Health Safety in Product Design. h) Environmental Safety and ISO 14000 Systems. 2. Development of any Product using high end CAD software considering following points. a) Need of Customer, Methodology of Market Survey. b) Invention / Innovation of a product with modifications required. c) Aesthetics (Form and Color) and Ergonomics consideration in design. d) Preparation of various Views of the product. e) Design for Assembly Procedures .	

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f) Product and Maintenance Manual. g) Product Database Management. A report should be prepared with details, drawing sheet, Bill of Material, Assembly – Disassembly Procedure, Maintenance Manual and Cost Estimation (if required) 3. Presentation of the product designed. 4. Part modeling using any 3D modeling software 5. Development of physical 3D mechanical structure using any one of the rapid prototyping processes.6. Shape optimization of any mechanical component using Software	

Text Books:

1. Product Design and Development,Karl T. Ulrich, Steven G. Eppinger; Irwin Tata McGraw Hill, 3rd Edition.
2. Product Design and Manufacturing,A.C. Chitale and R.C. Gupta, Prentice Hall of India, 3rd Edition.
3. Product Design,Otto and Wood, Pearson education.
4. Human Factor Engineering, L P Singh ,Galgotia Publication Pvt. Ltd, 1st Edition.

Reference Books:

1. New Product Developmen", Tim Jones, Butterworth, Heinemann, Oxford, (1997).
2. Assembly Automation and Product Design,Geoffrey Boothroyd, Marcel Dekker, CRC Press.
3. Industrial Product Design,,C W Flureshem.
4. Industrial Design for Engineers,Mayall W.H, London, Hiffee books Ltd.
5. Introduction to Ergonomics,R.C. Bridger, Tata McGraw Hill Publication

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CNC Machines Laboratory

ME408C	PEC	CNC Machines Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Pre-Requisites: --

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

CO1	Understand Features and selection of CNC turning and milling centers.
CO2	Prepare part programming and operation of CNC turning machines, subroutine techniques and use of cycles
CO3	Prepare part programming and operating a machining center, tool panning and selection of sequences of operations, tool setting on machine

Term Work:

1) Features and selection of CNC turning and milling centers. 2) Practice in part programming and operation of CNC turning machines, subroutine techniques and use of cycles. 3) Practice in part programming and operating a machining center, tool panning and selection of sequences of operations, tool setting on machine	

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Control Engineering Laboratory

ME408D	PEC	Control Engineering Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Course Outcomes: At the end of the course a students will be able to

CO1	Analyze the first order systems using time domain analysis using MATLAB Software
CO2	Analyze the second order systems using time domain analysis using MATLAB Software
CO3	Stability analysis using ROUTH- HURWITZ METHOD using MATLAB Software
CO4	Stability analysis of linear system using ROOT LOCUS using MATLAB Software

Term Work:

1. Step, ramp and Impulse response of first order systems analysis using MATLAB Software
2. Step, ramp and Impulse response of second order systems analysis using MATLAB Software
3. Stability analysis of linear systems using Routh-Hurwitz method.
4. Stability analysis of linear systems using Root Locus.

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Material Management Laboratory

ME408E	PEC	Material Management Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

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

CO1	Explain material management system (Understand)
CO2	Illustrate supply chain management (Understand)
CO3	Make use of Material Management Linkages and Elements of Production Processes (Apply)
CO4	Classify Cost Involved in material management and store handling equipments (Analyze)

Six assignments are compulsory from given list.

Assignment number seven is mandatory

1. Assignment on introduction to materials management
2. Assignment on supply chain management
3. Assignment on material management linkages
4. Assignment on elements of production processes
5. Assignment on cost involved in material management
6. Assignment on store handling equipment
7. Assignment on case study

Text Books:

1. Dutta A.K., Materials Management: Procedures, Text and cases, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Gopalakrishnan, P. and Sundareson, M., Materials Management: An Integrated Approach, Prentice Hall of India Pvt. Ltd., New Delhi.
3. Varma, M.M., Essentials of Storekeeping and Purchasing, Sultan Chand and Sons, New Delhi.
4. Shah N.M. An Integrated concept of Materials Management, Indian Institute of Materials Management, Baroda Branch, Baroda

Reference Books:

1. Sharma S.C., Material Management and Materials Handling, Khanna Publishers,

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New Delhi.
2. Arnold, Champman and Ramakrishnan, Introduction to Materials Management 5th ed., 2007 Pearson Education, Inc.

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Kinematics of Machines Laboratory

ME409	PCC	Kinematics of machines Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Pre-Requisites: Physics, Mathematics

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

CO1	Explain the working of different mechanisms.
CO2	Analyze graphically velocity and acceleration of planer mechanism using Instantaneous Centre of rotation ,Klein's construction and Relative Velocity methods
CO2	Draw cam profile for specific motion.
CO3	Examine effect of slip on power transmission of belt.
CO4	Determine the torque transmitted in epicyclic gear train.
CO5	Develop a computer program for calculation of velocity and acceleration of slider-crank mechanism.

Term Work:

List of Drawing Sheets:

1. Study of construction and working of basic mechanisms.
2. Graphical solution to problems on velocity acceleration in mechanism by relative velocity and acceleration method including problem with Corioli's component of acceleration.
3. Velocity by instantaneous center method.
4. Klein's construction for slider cranks mechanisms.
5. To construct cam profile for various types of followers motion.

Experiments:

1. Experiment of Slip of belt.
2. Experiment on torque measurement in epicyclic gear train.
3. Calculate velocity and acceleration of slider-crank mechanism by using suitable programming method.

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Fluid Mechanics Laboratory

ME410	PCC	Fluid Mechanics Laboratory	0-0-2	1 Credits

Teaching Scheme:	Examination Scheme:
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 15 Marks Continuous Assessment 2: 15 Marks Practical and Oral Exam: 20 Marks

Pre-Requisites: Engineering Mechanics, Engineering Mathematics, Engineering Physics

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

CO1	Understand laminar and Turbulent flow and determine Critical Reynolds number and Verify Bernoulli's theorem
CO2	Determine pressure drop in flow though pipes and pipe fittings and Determine viscosity using viscometer
CO3	Make Calculation of calibration of flow measuring devices

Term Work:

1. Flow visualization technique: characteristics of laminar and turbulent flow patterns using Helleshaw Apparatus
2. Verification of Bernoulli's theorem.
3. Determination of Critical Reynolds number using Reynolds Apparatus.
4. Determination of pressure drops in pipes of various cross-sections.
5. Determination of pressure drops in pipes of various pipe fittings etc.
6. Viscosity measurement using viscometer(at least one type).
7. Determination of metacentric height of a floating body.
8. Calibration of a selected flow measuring device and Bourdon pressure gauge.
9. Gauge and differential pressure measurements using various types of manometers,

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Mini Project - III

PRJ03	PROJ	Mini Project - III	0-0-2	1 Credit

Teaching Scheme:	**Examination Scheme:**
Lecture: - Practical: 2 hrs./week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Pre-Requisites: -

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

CO1	Expose the students to use the engineering approach to solve the real time problems
CO2	Learn the skills of team building and team work.
CO3	Defend the opinions and scope of the project work effectively

The Mini Project is a part of addressing societal and industrial needs. Mini Project is one of the platforms that students will use to solve real-world challenges. This course focuses on the selection of methods/engineering tools/analytical techniques for problem-solving. Through this course, students gain a thorough understanding of engineering basics and ideas, gain practical experience, have the opportunity to display their skills and learn about teamwork, financial management, communication skills, and responsibility.

Guidelines

1. Every student shall undertake the Mini Project III for semester IV.
2. the same group of minimum three and maximum of five students who were working for Mini Project II should work together in Hackathon
3. The students have to work on different approaches and finalize the best methodology to solve the problem in consultation with the project guide.
4. The students should use different tools /Techniques for the development of the solution to the problem.
5. While developing solutions, the student can take care of effective use of resources, follow ethical practices, finance management,
6. The solution should be optimal, affordable, user-friendly and environment friendly.
7. Critically analysis and testing of the solution provided.
8. By using IPR, students should reserve their rights of innovations as well as communicate new findings to society with the help of research papers.

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The committee of senior faculty members and a project guide will be appointed to monitor the progress and continuous evaluation of each project. The assessment shall be done jointly by the guide and committee members.

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Environmental Sciences

MDC02	MC	Environmental Sciences	2-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Pre-Requisites: NA

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

CO1	Explain various natural resources and associated Problems
CO2	Summarize various ecosystems
CO3	Explain the importance of conservation of biodiversity and its importance in balancing the earth.
CO4	Recognize various causes of environmental pollution along with various protection acts in India to limit the pollution
CO5	Extract the information based of field study and prepare a report.

Course Contents:

Unit 1: Nature of Environmental Studies Definition, scope and importance, Multidisciplinary nature of environmental studies. Need for public awareness.	[2]
Unit 2: Natural Resources and Associated Problems **Forest resources**: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. **Mineral resources**: Usage and exploitation. Environmental effects of extracting and using mineral resources. **Energy resources**: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. **Land resources**: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of individuals in conservation of natural resources.	[6]
Unit 3: Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers.Energy flow in the ecosystem, Ecological succession.Food chain etc. in concern with forest ecosystem, Producers, consumers and decomposers.Energy flow in the ecosystem.Ecologicalsuccession.Food chain etc. in concern with Grassland ecosystem Producers, consumers and decomposers.Energy flow in the ecosystem.Ecological	[4]

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succession. Food chain etc. in concern with Desert ecosystem Producers, consumers and decomposers. Energy flow in the ecosystem.Ecological succession. Food chain etc. in concern with various aquatic ecosystems	
Unit 4: Biodiversity Introduction- Definition: genetic, species and ecosystem diversity, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, various approaches for the conservation of biodiversity. And at least one case study in line with this	[4]
Unit 5: Environmental Pollution and Environmental Protection Definition: Causes, effects and control measures of various types of pollution. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, Concept of sustainable development : From Unsustainable to Sustainable development Various environmental Protection Acts and their scope	[4]
Unit 6: Field Work The student should Visit to a local area to document environmental assets-River/Forest/Grassland/Hill/Mountain. Or Visit to a local polluted site - Urban / Rural / Industrial /Agricultural. Or Study of common plants, insects, birds. or Study of simple ecosystems - ponds, river, hill slopes, etc. The student should expect to do this activity in a group size of 4-5 and prepare and submit a report on it.	[4]

Text Books:

1. Agarwal, K.C.2001, Environmental Biology, Nidi Pub. Ltd., Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380013, India, Email:mapin@icenet.net (R)
3. Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
4. Clank R.S. Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H.Gorhani, E. and Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Pub. Mumbai, 1196p
6. De A.K., Environmental Chemistry, Wiley Wastern Ltd.
7. Down to Earth , Centre for Science and Environment , New Delhi.(R)
8. Gleick, H.,1993, Water in crisis, Pacific Institute for studies in Dev., Environment and Security. Stockholm Env. Institute. Oxford Univ. Press 473p.
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
10. Heywood, V.H.and Watson, R.T.1995, Global Biodiversity Assessment, Cmbridge Univ. Press 1140p.
11. Jadhav, H.and Bhosale, V.M.1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
12. Mickinney, M.L.and School. R.M.1196, Environmental Science Systems and Solutions, Web enhanced edition, 639p.
13. Miller T.G. Jr. Environmental Science. Wadsworth Publications Co.(TB).

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14. Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA, 574p.
15. Rao M.N.andDatta, A.K.1987, Waste Water Treatment, Oxford IBH Publ. Co. Pvt. Ltd., 345p
16. Sharma B.K., 2001, Environmental Chemistry, Gokel Publ. Hkouse, Meerut
17. Survey of the Environment, The Hindu (M)
18. Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
19. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I and II, Environmental Media (R)

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Industrial Training/Field Training-I

IFT01	PROJ	Industrial training	0-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Course Outcome: Students will be able to

CO1	1. Apply fundamental concepts of electronics and telecommunication engineering.
CO2	2. Cope up with the latest changes in technological world.
CO3	3. Identify, formulate and model the problems and find engineering solution based on system approach
CO4	4. Solve the problems of Socio-Economical, Cultural, and Global and environmental field as an engineer

Instruction:

Students are expected to undergo industrial training for at least four weeks at factory / design offices or in combination of these after II semester. Training session shall be guided and certified by qualified engineer / industry expert. A neat detailed report on activities carried out during training is expected. Students should undergo training in Summer Vacation after Semester II and appear at examination in Semester III. A brief report of industrial training shall be submitted. Evaluation shall be based on report and power point presentation.

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Aptitude Skills - II

HMS03	HSMC4	Aptitude Skills - II	1-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: 1 hrs/week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Pre-Requisites: Communication Skills, Aptitude Skill- I

Group A

Verbal Ability (12Hrs) (Compulsory)

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

CO1	Understand basic concepts of sentences and its structure
CO2	Understand the tenses and its use in daily life
CO3	Explain basic uses of speeches and voices in day to day life
CO4	Understand the use of modal verbs in sentence construction
CO5	Summarize various Phrases, Idioms and Proverbs
CO66	Summarize different words used in daily life

Course Contents:

Unit 1: English Grammar Structure and Types of Sentence, Conditional Sentences	[2]
Unit 2: Tenses Present tense, Past tense, Future tense, Use of Tenses in Sentence forming	[2]
Unit 3: Speeches and Voices Direct and Indirect Speech, Active and Passive Voice	[2]
Unit 4: Modal Use of Modal verbs in Sentence Forming, Substitution and Elimination	[2]
Unit 5: Proverbs, Idioms and Phrases Use of Proverbs, Idioms and Phrases in Sentence Construction, Judgment and Inference Sentence	[2]
Unit 6: Vocabulary Vocabulary Building in Various Situations	[2]
Text Books: 1. Raymond Murphy, Essential English Grammar with Answers, Murphy 2. Objective General English by R.S. Aggarwal, S Chand Publishing; Revised edition (15 March 2017)	

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Reference Books:

1. RaoN, D, V, Prasada, Wren and amp; Martin High School English Grammar and Composition Book, S Chand Publishing, 2017
2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press; Second edition

Group B

Aptitude (12Hrs) (Compulsory)

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

CO1	Understand speed math techniques to solve aptitude problems
CO2	Summarize number systems in detail.
CO3	Explain basic aptitude techniques related to Percentage, Average, Ratio Proportion and Fraction
CO4	Understand speed,time and distance concepts
CO5	Summarize the concepts of Business aptitude using basic aptitude
CO6	Solve the aptitude problems on Geometry and Venn Diagram

Course Contents:

Unit 1: Speed Math Techniques Multiplication, Squares, Square roots, Cubes, Cube roots	[1]
Unit 2: Number System Types of Number System, Last Digit Method, BODMAS Calculation, HCF and LCM, Progressions	[2]
Unit 3: Basic Aptitude Percentage, Average, Ratio and Proportion, Fraction, Partnership	[2]
Unit 4: Speed- Time- Distance Speed, Time, and Distance, Trains, Boats, Streams, Races	[2]
Unit 5: Business Aptitude Profit and Loss, Simple Interest, Compound Interest	[2]
Unit 6: Geometry and Venn Diagram 2D and 3D Mensuration, Venn diagram	[2]

Text Books:

1. Arun Shrama - Quantitative aptitude for CAT.
2. RS Aggarwal, A Modern Approach to Verbal and Non-Verbal Reasoning,S.Chand Publisher; 2016 edition
3. RS Aggarwal, Quantitative Aptitude for Competitive Examinations, S.Chand Publisher; 2016 edition

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Reference Books:

1. Fast Track Objective Arithmetic Paperback, by Rajesh Verma – 2018
2. Teach Yourself Quantitative Aptitude, Arun Sharma
3. The Pearson Guide To Quantitative Aptitude For Competitive Examination by Dinesh Khattar

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Language Skills - II

HMS04	HSMC	Language Skills - II	0-0-2	1 Credit

Teaching Scheme:	**Examination Scheme:**
Paractical: 2hrs/week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Pre-Requisites: Communication Skills, Language Skill- I

Languages (Any One)

C Programming (Technical Language) (24Hrs)

Syllabus for C Programming

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

CO1	Illustrate the concept of Function Types, and its type
CO2	Make use of Structures and Unions.
CO3	Make use of Pointers
CO4	Illustrate the concept of File handling in C programming.

Unit 1: Function Editing, Basic of functions, Types of functions, returning non-integers external variables, scope rules, Recursion Function.	[6]
Unit 2: Structures and Unions Variable Defining a Structure, Advantage of Structure, Size of Structure, Arrays of Structures, Structures and Functions, Defining Unions.	[6]
Unit 3: Pointers Pointers to integers, characters, floats, arrays, structures.	[6]
Unit 4: File handling Initializing Introduction to dynamic memory allocation- Malloc, Calloc, Realloc, Introduction to file management, Opening/Closing a file, Input/ Output operations on Files, Error handling during I/O Operations.	[6]
Text Books 1. C Programming Absolute Beginner's Guide, Que Publishing; 3rd edition (22 August 2013) 2. C Programming Language 2nd Edition, Peasrson Publication	

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Reference Books

1. C: The Complete Reference, McGraw Hill Education; 4th edition (1 July 2017)
2. C Programming in easy steps, 5th Edition, In Easy Steps Limited
3. The C Programming Language, Second Edition, By Pearson Education India (1 January 2015)

Foreign Languages (Any One)

Japanese Language Course I (12Hrs)

Course Objectives:

This course is designed to introduce students to the everyday language of Japan. Units will be organized around natural conversational topics, leading students from fundamental aspects of grammar to readings in simple texts. Students will learn vocabulary, expressions, and sentence structures to become able to meet basic communication needs in Japanese. This course comprises all four skills (speaking, listening, reading, and writing) of language.

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

CO1	Converse in Standard Japanese to perform basic communicative tasks (e.g.,exchange greetings/personal information, give time/directions/daily activities)
CO2	Make use of Japanese vocabulary effectively.
CO3	Demonstrate reading comprehension

Course Contents:

Unit 1: basic communicative tasks Learning expressions involving "---ni---gaimasu" pattern, Introduction of counters, simple translations, Communicative situations—shopping, Grammar: Introduction of adjectives, na-adjectives	[4]
Unit 2: Communicative situations Time relations,Communicativesituations-confirming schedules etc, Particles and their functional use in Japanese sentences, Reading comprehension—a story	[4]
Unit 3: Easy conversation Introduction of past tense aspect in r/o verbs, and adjectives, Communicative situation : asking questions and answering, Easy conversation, Overall revision, and discussion	[4]
Text Book: 1. NihongoShoho I (Japan Foundation Publ.) 2. GENKI I: An Integrated Course in Elementary Japanese (English and Japanese Edition) 3. Japanese for Busy People I: Kana Version (Japanese for Busy People Series) 3rd Edition	

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Reference Book:

1. Minna No Nihongo I (3A Corporation, Japan)
2. Japanese from Zero! 1: Proven Techniques to Learn Japanese for Students and Professionals 6th Editionby George Trombl

Foreign Languages

German Language Course I (12Hrs)

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

CO1	Introduce herself or himself in German.
CO2	Understand alphabets, numbers in German language
CO3	Make basic and easy sentences required in day to day situations
CO4	Read, write, speak and listen basic and simple text in German.

Course Contents:

Unit 1: Introduce oneself Introduction, Greetings, German Alphabets, Numbers (1 -100), Giving and asking Information related to numbers	[3]
Unit 2: Formal and Informal form Difference between Formal and Informal form, Personal Pronouns, verb conjugation	[3]
Unit 3: Everyday situations Learning about the things in the classroom, Definite, indefinite, negative articles, Possessive Articles of all the nouns	[3]
Unit 4: Simple activities Watch timings learning, Routine activities	[3]

Text Books

1. NetzwerkArbetisbuch A1 Goyal Publisher.
2. The Everything Learning German Book: Speak, Write and Understand Basic German in No Time by Ed Swick
3. German Made Simple: Learn to Speak and Understand German Quickly and Easily

Reference Books

1. Eugene Jackson and Adolph Geiger
2. Hammer's German Grammar and Usage (Fifth Edition) by Professor Martin Durrell
3. Learn German with Stories: Café in Berlin by André Klein

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