DEPARTMENT OF TECHNOLOGY
SECOND YEAR B.TECH
Scheme of Teaching and Examination
Semester – III (Mechanical Engineering)
To be implemented from Academic Year 2021- 22

Sr. No	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing $	Scheme	Max. marks	Min. Passing
1.	Programmable Computational Methods	04	01	-	05	CIE	30	40	-	-	-
						SEE	70		-	-	-
2.	Electrical Technology and Computer Programming C ++	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
3.	Engineering Thermodynamics	03	-	-	03	CIE	30	40	-	-	-
						SEE	70		-	-	-
4.	Machine Tools and Processes	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
5.	Fluid Mechanics	03	-	-	03	CIE	30	40	-	-	-
						SEE	70		-	-	-
6.	**Laboratory** Engineering Thermodynamics	-	-	02	01	-	-	-	IPE	50	20
									EOE	50	20
7.	**Laboratory** Electrical Technology and Computer Programming C++	-	-	02	01	-	-	-	IOE	50	20
8.	**Laboratory** Fluid Mechanics	-	-	02	01	-	-	-	EPE	50	20
9.	Machine Drawing	01	-	02	02	-	-	-	EPE	50	20
10.	Workshop Practices I	-	-	02	01	-	-	-	IPE	50	20
	Total	**19**	**01**	**10**	**25**	**-**	**500**	**-**	**-**	**300**	**-**
1.	Environmental Studies	02	-	-	-	Project	30	40	-	-	-
						Theory	70				
Audit Course											
2.	Introduction to Fine Arts	02	-	-	-	Institute Level	-	-	-	-	-

$ In theory student should appear for the CIE (Mid Semester Exam), submit the assignment and must secure 40% marks in SEE. **Total Credits=25**

Note:

1. Students are expected to do self-study for two hours as per the guide hence contact hours to be taken as two for the calculation of contact hours
2. Tutorials and Practical to be conducted in batches with batch strength not exceeding 15 students.

CIE: Continuous Internal Evaluation SEE: Semester End Examination
IPE: Internal Practical Evaluation EPE: External Practical Examination
IOE: Internal Oral Evaluation EOE: External Oral Examination

DEPARTMENT OF TECHNOLOGY
SECOND YEAR B.TECH
Scheme of Teaching and Examination
Semester – IV (Mechanical Engineering)
To be implemented from Academic Year 2021-22

Sr. No	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing $	Scheme	Max. marks	Min. Passing
1.	Applied Mathematics	04	01	-	05	CIE	30	40	-	-	-
						SEE	70		-	-	-
2.	Strength of Materials	04	01	-	05	CIE	30	40	-	-	-
						SEE	70		-	-	-
3.	Theory of Machines I*	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
4.	Fluid and Turbo Machinery	03	-	-	03	CIE	30	40	-	-	-
						SEE	70		-	-	-
5.	Metallurgy	04	-	-	04	CIE	30	40	-	-	-
						SEE	70		-	-	-
6.	**Laboratory** Theory of Machines I	-	-	02	01	-	-	-	EOE	50	20
7.	**Laboratory** Fluid and Turbo Machinery	-	-	02	01	-	-	-	IPE	50	20
									EPE	50	20
8.	**Laboratory** Metallurgy	-	-	02	01	-	-	-	IPE	50	20
									EOE	50	20
9.	Workshop Practice II	-	-	02	01	-	-	-	IPE	50	20
						-	-	-	EPE	100	40
	Total	**19**	**02**	**08**	**25**	--------	**500**	--------	--------	**300**	--------
10.	Environmental Studies	02	-	-	-	Project	30	40	-----	----	---
						Theory	70				
Audit Course											
10.	Soft Skill Development	02	-	-	-	Institute Level	-------	--------	-----	----	---

$ In theory student should appear for the CIE (Mid Semester Exam), submit the assignment and must secure 40% marks in SEE. **Total Credits=25**

Note:

1. Theory of Machine I theory paper will be of 4 Hours.
2. Students are expected to do self-study for two hours as per the guidance given by the project guide hence contact hours to be taken as two for the calculation of contact hours.
3. Tutorials and Practical to be conducted in batches with batch strength not exceeding 15 students.

CIE: Continuous Internal Evaluation
SEE: Semester End Examination
IPE: Internal Practical Evaluation
EPE: External Practical Examination
IOE: Internal Oral Evaluation
EOE: External Oral Examination

Equivalence of Pre Revised and Revised Structure
Second Year B. Tech. (Mechanical Engineering) Semester III and IV

The above detailed syllabus is a revised version of the Second Year B. Tech (Mechanical Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2021, (Academic year 2021-22). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Mechanical Engineering at Second Year B. Tech. Semester III and IV pre-revised and Revised Program under the faculty of Engineering and Technology is as follows.

Second Year B. Tech. Semester III (Mechanical Engineering)

Sr. No	Second Year B. Tech. (Mechanical Engineering) Semester III Pre-revised syllabus	Second Year B. Tech. (Mechanical Engineering) Semester III Revised syllabus	Remark
	Credits = 25	Credits = 25	No change in credits
1.	Numerical Methods	Programmable Computational Methods	Course Name Changed Slight modification in the content
2.	Electrical Technology and Computer Programming C ++	Electrical Technology and Computer Programming C ++	Slight modification in the content
3.	Engineering Thermodynamics	Engineering Thermodynamics	Slight modification in the content
4.	Manufacturing Engineering I	Machine Tools and Processes	Course Name Changed Slight modification in the content
5.	Fluid Mechanics	Fluid Mechanics	Slight modification in the content
6.	**Laboratory** Power Engineering	**Laboratory** Engineering Thermodynamics	Course Name Changed Slight modification in the content
7.	**Laboratory** Electrical Technology and Computer Programming C++	**Laboratory** Electrical Technology and Computer Programming C++	Slight modification in the content
8.	**Laboratory** Fluid Mechanics	**Laboratory** Fluid Mechanics	Slight modification in the content
9.	Machine Drawing	Machine Drawing	Slight modification in the content
10.	Workshop Practices I	Workshop Practices I	Slight modification in the content
11.	Environmental Studies	Environmental Studies	Slight modification in the content
12.	**Audit Course** Introduction to Performing Arts	**Audit Course** Introduction to Performing Arts	Slight modification in the content

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

* **Course work:** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work.

Second Year B. Tech. Semester IV (Mechanical Engineering)

Sr. No.	Second Year B. Tech. (Mechanical Engineering) Semester IV Pre-revised syllabus	Second Year B. Tech. (Mechanical Engineering) Semester IV Revised syllabus	Remark
	Credits = 25	Credits = 25	No change in credits
1.	Applied Mathematics	Applied Mathematics	Slight modification in the content
2.	Mechanics of Materials	Strength of Materials	Course Name Changed Slight modification in the content
3.	Theory of Machines I	Theory of Machines I	Slight modification in the content
4.	Fluid and Turbo Machinery	Fluid and Turbo Machinery	Slight modification in the content
5.	Material Science and Metallurgy	Metallurgy	Course Name Changed Slight modification in the content
6.	**Laboratory** Theory of Machines I	**Laboratory** Theory of Machines I	Slight modification in the content
7.	**Laboratory** Fluid and Turbo Machinery	**Laboratory** Fluid and Turbo Machinery	Slight modification in the content
8.	**Laboratory** Material Science and Metallurgy	**Laboratory** Metallurgy	Course Name Changed Slight modification in the content
9.	Workshop Practice – II	Workshop Practice – II	Slight modification in the content
10.	Environmental Studies	Environmental Studies	Slight modification in the content
11.	**Audit Course** Soft skill development	**Audit Course** Soft skill development	Slight modification in the content

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

* **Course work:** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work.

7Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Programmable Computational Methods			**Course Code:**	**:**	ME 231
Teaching Scheme (Hours)	**:**	Lecture :	4 Hrs/week		**Total Credits**	**:**	5
		Tutorial :	1 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	June-21
Pre-requisites (if any)	**:**	Basic knowledge of Engineering Mathematics-I and Engineering Mathematics-II.					
Course Domain	**:**	Basic Sciences					

Course Rationale:

This course offers a numerical method understanding for engineering applications. This course produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering.

Course Objectives: The Course teacher will

1. To introduce various numerical methods for solving algebraic and transcendental equations.
2. To introduce the numerical techniques of interpolation in various intervals
3. To introduce numerical methods for evaluation of derivatives and definite integrals.
4. To understand numerical methods for solving partial differential equations.
5. To introduce concept of Curve Fitting and Regression
6. To introduce the concept of Linear Programming Problem

Course Outcomes: Students will be able to

1. Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution.
2. Identify, classify and choose the most appropriate numerical method for solving a problem
3. To solve different problems using curve fitting and regression.
4. Formulate and solve different problems in the field mechanical engineering using Linear Programming Problem.
5. To understand need of numerical methods in mechanical engineering
6. Deploy skills effectively in the solution of problems in mechanical engineering

Curriculum Content	Hours
Unit I Numerical solution of algebraic and transcendental equations Bisection Method, Iterative Methods, False Position Method, Rate of convergence, Muller's Method, Newton-Raphson method for solution of system of non-linear Equations, Secant Method.	9
Unit II Interpolation and Approximation Lagrange's interpolation formula, Newton's divided difference interpolation formula, Newton's forward and backward difference interpolation formula, Hermite interpolation formula, Cubic Spline interpolation.	9
Unit III Numerical differentiation and Integration Numerical differentiation: Methods based on interpolation, Numerical integration: Newton cotes formula, Trapezoidal rule, Simpson's 1/3rd rules, Simpson's 3/8th rules.	8
Unit IV Numerical solution of partial differential equations Review of partial differential equations, Classification of partial differential equation, Elliptical Equations- Laplace's equation, Liebmann's iteration method. Parabolic Equations- Heat equation, Bender-Schmidt's method, Crank Nicolson Method. Hyperbolic equations- Wave equation, Difference equation method.	8
Unit V Curve Fitting and Regression Fitting of Curves by method of Least-squares for linear, parabolic, and exponential. Coefficient of correlation, Spearman's rank correlation, coefficient and lines of regression of bivariate data.	9
Unit VI: Mathematical Programming Linear programming problems, Standard and Canonical forms, Basic solutions and feasible solutions, Optimal solutions by simplex method, Artificial Variables, Big M-method, Dual simplex method.	9

Suggested list of Tutorials and Assignments:

1. Solution of Algebraic and Transcendental equations.
2. Interpolation
3. Approximation
4. Numerical differentiation
5. Numerical integration
6. Solution of Wave equation, Heat Equation and Laplace Equation
7. Simplex method
8. Big M-method
9. Dual simplex method

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches.
2. Students must be encouraged to solve numerical problems using different mathematical software's in tutorial class only.
3. Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 "Numerical Methods", P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand & Company.
2 "Introductory Methods of Numerical Analysis", S.S. Sastry, PHI.
3 "Higher Engineering Mathematics", Dr. B. S. Grewal, Khanna Publishers, Delhi.

Suggested Reference Books:

1 "Numerical methods for scientific and Engineering Computation", M. K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International Limited Publishers.

2 "Numerical method for Engineers", S.C. Chapra, R.P. Canale, Tata McGraw Hill Publications.
3 "Numerical Methods", Dr. B.S. Grewal, Khanna Publications.
4 "Fundamental of Statistics", S. C. Gupta.
5 "Advanced Engineering Mathematics", Erwin kreyszig, John Wiley & Sons.
6 "Engineering Mathematics", Veerarajan T., Tata McGraw-Hill, New Delhi.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Electrical Technology and Computer Programming C ++			**Course Code:**	**:**	ME 232
Teaching Scheme (Hours)	**:**	Lecture :	4 Hrs/week		**Total Credits**	**:**	--
		Tutorial :	1 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	June-21
Pre-requisites (if any)	**:**						
Course Domain	**:**	Professional Core					

Course Rationale:

ELECTRICAL TECHNOLOGY AND COMPUTER PROGRAMMING C++ subject belongs to the Applied Technology and Basic Technology group. This subject will develop the theory, concepts and operating principles of electrical machines, generators, alternators, different types of motors along with starting, switching and control circuits for the same, their applications. The knowledge acquired by the students will help them to design, test in electrical motors and generators.

ELECTRICAL TECHNOLOGY AND COMPUTER PROGRAMMING C++ encourages students to learn concepts of programming, rules and syntax of 'C' language, arithmetic and logical operations in 'C' language, use of arrays, strings, functions, pointers, structures, unions and files in 'C' programming.

Course Objectives: The Course teacher will

1 Acquire knowledge about characteristics and applications of various industrial drives
2 Understand and study of the importance of power factor and power factor correction method
3 Understand and study of various electrical drives and their industrial applications
4 To introduce the concept of object oriented programming, various elements used and their application in program development
5 To learn and apply concepts of inheritance and overloading with application in program development

Course Outcomes: Students will be able to

1 Understand the working principle, performance, control and applications of AC, DC Drives.
2 Analyze and Carry out basic experiments on AC, DC machines
3 Understand importance of power factor and its correction methods
4 To explain the concept of object oriented programming with the use of various elements
5 To write and execute the programs for variety of cases using the concepts of elements

Curriculum Content **Hours**

Unit I

Unit I DC Machine

DC Generator: Construction features, e.m.f. equation of dc generator, methods of excitation. losses condition for maximum efficiency, armature reaction, commutation, methods of improving commutation, characteristics of separately excited and self excited dc generator. 10

DC Motor: Working principle, importance of back e.m.f., voltage equation, condition for maximum power, characteristics, torque developed, starting, speed control methods (Numerical treatment).

Unit II

AC Machine and Electrical Drives

Induction Motor – Three Phase Induction Motors Rotating magnetic field, construction and principle of operation, slip, rotor frequency, development of equivalent circuit, torque – speed characteristics, speed control. Starting methods, motor ratings, Induction motor as generalized transformer (Numerical treatment). 7

Electric Drives - Comparison between Group drive and Individual drive. Selection of motors for lathe, milling machine, planning machine, shaping machine, rolling mills, traction, conveyors and lifts, CNC machines etc

Unit III

Significance of power factor Causes of low power factor, Disadvantages of low power factor, power factor correction methods. (Numerical treatment 7

Unit IV

Fundamentals of C++ and Classes & Objects:

Object-Oriented programming: Introduction, Basic concepts, Benefits, object oriented languages, Applications. Classes and Objects: Introduction, structures and classes, Declaration of class, Member functions; defining the object of a class; accessing a member of a class; Array of class objects 10

Unit V

Operator Overloading & Inheritance:

Overloading unary and binary operators, Overloading extraction and insertion operators, data Conversion. Inheritance: Derived class and base class, derived class constructors, over riding member functions, public and private inheritance, multiple inheritances 7

Unit VI

Streams, String I/O, Character I/O, Object I/O, I/O with multiple objects, File pointers and redirections 7

Suggested list of Tutorials and Assignments:

Six assignments each based on above Units

General Instructions:

1. Continuous Internal Evaluation: Unit Test I and Unit Test II.
2. Semester End Examination (SEE) .Question paper should consist of Two sections of 50 marks each for Electrical Technology And computer Programming C++ And A separate answer book must be supplied for theory Examination for each section Electrical Technology And computer Programming C++.

Suggested Text Books:

1 "Text of Electrical Technology ;Vol -2"; B. L. Theraja, and A. K. Theraja; S. Chand Publication

2 "Object Oriented Programming", E. Balguruswami, Tata McGraw Hill Publication.

3 "Let us C++" ,Yashwant Kanitkar ,BPB Publication

4 "C++ Programming", Alstevans wiely India,7 th Edition. 4

5 "Object-Oriented Programming in C++", Rajesh K Shukla, Wiley India

Suggested Reference Books:

1 "Electrical machines" Ashfaq Hussain; Dhanpatrai and Co.

2 "Principles of Electrical power systems " J. B. Gupta

3 "Generalized theory of rotating machines" P S Bhimra

4 “Electrical Power”,S. L. Uppal, DBS Publication

7 "C++/CLI" Sivkumar wiely India

8 "Professional C++" Solter Wiely India

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Engineering Thermodynamics			**Course Code:**	**:**	ME 233
Teaching Scheme (Hours)	**:**	Lecture :	3 Hrs/week		**Total Credits**	**:**	--
		Tutorial :					
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	June-21
Pre-requisites (if any)	**:**	Basics of Mechanical Engineering (ES-11A1)					
Course Domain	**:**	Professional Core					

Course Rationale:

Thermodynamics, science of the relationship between heat, work, temperature, and energy. Thermodynamics deals with the transfer of energy from one place to another and from one form to another. The key concept is that heat is a form of energy corresponding to a definite amount of mechanical work.

Course Objectives: The Course teacher will

1. To learn about work and heat interactions, and balance of energy between system and its surroundings
2. To learn about application of First law to various energy conversion devices.
3. To evaluate the changes in properties of substances in various processes.
4. To understand the difference between high grade and low grade energies and Second law limitations on energy conversion

Course Outcomes: Students will be able to

1. Apply energy balance to systems and control volumes, in situations involving heat and work interactions
2. Evaluate the performance of energy conversion devices
3. Evaluate changes in thermodynamic properties of substances.
4. Differentiate between high grade and low grade energies.

Curriculum Content	**Hours**
Unit I Fundamentals	
System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Thermodynamic Equilibrium, State, Property, Process, Quasi – static Process, Irreversible Process, Energy and its forms, Work and heat (sign convention), Zeroth law , Concept of Temperature and its' measurement, Temperature scales. First law of thermodynamics: Thermodynamic definition of work, Displacement work and flow work, , Displacement work for various non flow processes, Joules' experiment, First law analysis for	8

closed system (non flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I.

Unit II Properties of Pure Substances

Pure substance, Phases of pure substances, Phase change phenomenon of pure substance, Terminology of pure substances, property diagrams for phase change processes, vapor pressure and phase equilibrium, property tables, ideal gas equation of states, Properties of gas mixture: Ideal and Real gases, compressibility factor. 6

Unit III First Law for Flow Processes:

Steady flow systems and their analysis, Steady flow energy equation, Steady state steady flow processes including throttling , Examples of steady flow devices

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Absolute temperature Scale, PMM-II. 8

Unit IV Entropy

Entropy-concept and its applicability, Clausius' Theorem, Clausius Inequality, Entropy: A property of system, Property diagrams, Entropy Principle, Tds Relations: Entropy change for Ideal Gas, Entropy generation in a closed and open system, The Entropy Change of Solids and Liquids, Third law of thermodynamics. 8

Unit V Availability and Irreversibility

Sources of energy, Available and unavailable energy , Availability of energy entering a system, Availability of closed system, Availability in a steady flow processes, The Second –Law Efficiency 4

Unit VI: Vapor power cycles

Basic Rankine Cycle, Basic Brayton Cycle , Carnot Vapour power Cycle , Comparison of Rankine and Carnot cycle, Regeneration, Reheating, and Co-generation , numerical on Work done and efficiency 6

Suggested list of Tutorials and Assignments:

Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 "Engineering Thermodynamics", P.K. Nag, Tata McGraw-Hill Publishing Co. Ltd.
2 "Basic and Applied Thermodynamics", P.K. Nag Tata McGraw-Hill Publishing Co. Ltd.
3 "Engineering Thermodynamics", R.K. Rajput, Laxmi Publication (P) Ltd. New Delhi
4 "Thermodynamics" , V. Ganesan McGraw-Hill Publishing Co. Ltd.
5 "Thermal Engineering" , M. L. Mathur , F.S. MehtaJain Brothers, New Delhi
6 "Heat Engineering", V.P.Vasandani & D.S.Kumar , Metropolitan Book Company, New Delhi
7 "Thermal Engineering" , Mahesh M. Rathod, Tata McGraw-Hill Publishing Co. Ltd.

Suggested Reference Books:

1 "Engineering Thermodynamics", Hawkins G. A., John Wiley and Sons.
2 "Fundamentals of Classical Thermodynamics", John Wiley and Sons.
3 "Thermodynamics", Yunus Cengel and Michael Boles, McGraw-Hill Publishing Co. Ltd.
4 "Engineering Thermodynamics" , Lynn D. Russell, Oxford University Press
5 "Fundamentals of Thermodynamics", Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, John Wiley and Sons.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Machine Tools and Processes			**Course Code:**	**:**	ME 234
Teaching Scheme (Hours)	**:**	Lecture :	4 Hrs/week		**Total Credits**	**:**	4
		Tutorial :					
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**						
Course Domain	**:**	Professional Core					

Course Rationale:

Course Objectives: The Course teacher will

1. Explain fundamental methods of manufacturing with reference to hot and cold forming.
2. Explain various metal joining methods.
3. Apply knowledge of the foundry technology fundamentals of conventional and advanced casting methods.
4. Demonstrate construction, working and applications of various machine tools.

Course Outcomes: Students will be able to

1. Explain various metal forming processes and its engineering application.
2. Analyze various joining processes and select the particular joining process for a given application
3. Apply the knowledge of metal casting processes to produce simple components.
4. Identify and explain the basic components of machine tools and its applications.

Curriculum Content	**Hours**
Unit I Hot and cold working of metals Hot and cold working, Principles of rolling, forging, drop, press, upset, roll forging, extrusion, drawing, spinning, effect of hot working. Cold working processes**,** Cold rolling, swaging, forging, extrusion forward, backward and impact roll forming, tube drawing, wire drawing, spinning, shot penning, high energy rate forming, sheet metal working, types of presses, drives, different operations and types of dies. **(Note: The unit includes numerical treatment on the appropriate topics.)**	10
Unit II Joining Processes	9

1. Introduction, classification of joining processes
2. Arc welding- Theory, SMAW, GTAW, GMAW, FCAW, Submerged arc welding, Stud welding, Resistance welding- Theory, spot and seam projection welding processes , Gas welding Friction welding, Ultrasonic welding, Thermit welding, EBW and LASER welding **(Note: Numerical treatment on arc and resistance welding process)**
3. Welding defects and quality control in welding

Unit III Foundry- Pattern making, moulding and casting

1. Importance of casting as manufacturing process, advantages and disadvantages of casting processes, foundry layouts and mechanization
2. Introduction to patterns, core boxes and gating systems: types of patterns, pattern materials, pattern making allowances, core boxes, core making, core prints, components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics bricks, progressive and directional solidification, sand properties **(Note: Numerical treatment of gating and riser system design)** 12
3. Hand and machine moulding
4. Melting and pouring - melting furnaces- Cupola, fuel fired, electric arc and induction furnaces. Cleaning, finishing of casting, casting defects.
5. Advanced casting methods: Lost wax processes, shell moulding and investment casting. Permanent mould dies casting- Die-casting, low-pressure permanent mould casting, hot and cold chamber processing, centrifugal casting, semi centrifugal casting and continuous casting.

Unit IV Lathe and drilling machine

1. Working principles, types, specifications, principal parts, accessories and attachments, lathe construction. Concept of speed, feed and depth of cut, thread cutting operation.
2. Introduction to boring Machines, Capstan and Turret lathe. 11
3. Fundamentals of drilling processes, hoist, drill geometry, tool holder, types of drilling machines, operations performed on drilling machines, type of drill.
4. Reaming processes and reamer types.

Unit V Milling, shaping, planning and broaching

1. Fundamental aspects, cutter types and geometry, Operations performed on milling machine, dividing head method of indexing. 6
2. Construction, working and operations performed on shaper, planer, and broaching machines

Unit VI: Grinding

1. Classification, grinding wheels, wheel marking, wheel selection, wheel mounting, wheel balancing, Grinding wheels- Abrasives, bonds and bonding processes, grit, grade and structure of wheel, types of grinding machines. 5
2. Honing, lapping, super finishing, buffing and burnishing processes.

Suggested list of Tutorials and Assignments:

Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 "Workshop Technology, Vol. II, III,and I",Chapman W.A. Edward Arnold Pub. Ltd. London

2 "Elements of Workshop Technology, Vol. Iand II", Hajra Chaudhary S.K. Media Prom and Pub, Mumbai.

3 "Manufacturing Processes for Engg. Materials" S..Klpakjim, S.R. Schmid Perason Education

4 "Fundamentals Of Modern Manufacturing", M.P.Groover Wiley India Pvt. Ltd.

5 "Principles of foundry technology",P L Jain, Tata McGraw-Hill, New Delhi

6 "Production technology", P. C. Sharma., S. Chand and Company Ltd.

Suggested Reference Books:

1 HMT Hand book- Production Technology
2 “Processes and materials of manufacturing”, Roy A. and Linberg Prentice Hall of India Delhi.
3 "Principles of manufacturing Materials and Processes", Campbell J.S. McGraw-Hill, New York.
4 “Manufacturing processes”, Begeman Asia Publishing house Bombay.
5 "Principles of metal casting",Haine And Rosenthal, Tata McGraw-Hill Book Company. New Delhi.
6 "Welding technology", Little, Tata McGraw-Hill Book Company. New Delhi.
7 "Manufacturing Processes And System 9E P". Ostwald, J. Munoz, John Wiley & Sons (asia) Pvt.Ltd
8 ASTM Volumes on Welding, casting, forming and material selection

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Fluid Mechanics			**Course Code:**	**:**	ME 235
Teaching Scheme (Hours)	**:**	Lecture :	4 Hrs/week		**Total Credits**	**:**	3
		Tutorial :					
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	In order to complete the course studies successfully, it is important to have a good command of English. Engineering Physics, Chemistry-I and Fluid Flow Operations.					
Course Domain	**:**	Professional Core					

Course Rationale:

Fluid Mechanics is core technology subject in mechanical engineering. Conversion of fluid energy in to mechanical energy and mechanical energy in to fluid energy, is the scope of subject fluid mechanics & fluid machines. As far as applications are concerned, areas like Industrial hydraulics & pneumatics, Tribology, Process equipment design, piping Engineering, Irrigation Engineering Requires basics of fluid mechanics. Content of fluid mechanics subject encourages students to become involved in learning of the principles of fluid mechanics at different levels such as-

- Understanding of concepts.
- The recognition of logical approach to problem solving.
- The ability to perform the details required in the solution.
- The ability to critique the design of given system & recommend improvements.
- The ability to design practical, efficient fluid system.

This multilevel approach has been successful in building student's confidence in their ability to analyze & design fluid system.

Course Objectives: The Course teacher will

1. To identify various properties of fluids and Pascal's Law.
2. To state and illustrate fundamentals of Fluid Statics, Kinematics and Dynamics.
3. To demonstrate Bernoulli's Equation for various applications.
4. To understand the physics of fluid flow and conversant with Internal, External flows and its applications.

Course Outcomes: Students will be able to

1. Describe the significance of properties of fluid.
2. Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical engineering.
3. Estimate the discharge through a pipe or open channel.
4. Solve the practical problems in design of channels, openings.

Curriculum Content **Hours**

Unit I Introduction & Properties of Fluid

Definition of fluid, fluid properties such as viscosity, vapour pressure, compressibility, surface tension, capillarity, Mach number etc., pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, pressure measurement by simple and differential manometers using manometric expression — 10

Unit II Fluid Statics

Hydrostatic forces on the plane and curved surfaces, centre of pressure, Buoyancy, centre of buoyancy, stability of floating bodies, metacentre and metacentric height, its application in shipping. — 14

Unit III Kinematics of Fluid Flow

Velocity of fluid particle, types of fluid flow, description of flow, continuity equation, Coordinate free form, acceleration of fluid particle, rotational and irrotational flow, Laplace's equation in velocity potential and Poisson's equation in stream function. (Note: The chapter includes numerical treatment on the appropriate topics.) — 7

Unit IV Dynamics of Fluid Flow

Momentum equation, development of Euler's equation, Introduction to Navier-Stokes equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem , Application of Bernoulli's theorem such as venture meter, orifice meter, rectangular and triangular notch, pitot tube etc. — 7

Unit V Flow types

Laminar Flow: Flow through circular pipe, between parallel plates, Power absorbed in viscous flow in bearings, loss of head due to friction in viscous flow. Turbulent Flow: Reynolds's experiment, frictional loss in pipe flow, major and minor losses, HGL and TEL, flow through series and parallel pipes, Equivalent pipe, Syphon pipe. — 7

Unit VI Introduction to Advanced Fluid

Dimensional Analysis: Dimensional homogeneity, Raleigh's method, Buckingham's theorem, Model analysis, similarity laws and dimensionless numbers. Introduction to boundary layer theory and its analysis. Forces on Submerged bodies: Drag and lift. — 7

Suggested list of Tutorials and Assignments:

Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1. "Fluid Mechanics and Hydraulic Machines - l",Dr. R.K. Bansal , Laxmi Publication Pvt. Ltd., New Delhi.
2. "Hydraulics and Fluid Mechanics including Hydraulic Machines", Dr. P.N. Modi and Dr. S.M. Seth, Standard Book House.
3. "Fluid Mechanics", Streeter, Wylie, Bedford , McGraw Hill Publication.

Suggested Reference Books:

1. "Fluid Mechanics",White McGraw Hill Publication
2. "Advanced Fluid Engineering",Murlidhar, Narosa Publication.
3. "Fundamentals of fluid mechanics",G.S.Sawhney I.K. International Publishing House Pvt. Limited, New-Delhi, 2008 New York.
4. "Mechanics of Fluid",Irving Shames McGraw Hill Publication

Class, Part & Semester	:	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	:	Laboratory Engineering Thermodynamics			**Course Code:**	:	ME 233P
Teaching Scheme (Hours)	:	Practical	2 Hrs/week		**Total Credits**	:	1
Evaluation Scheme (Marks)	:	IOE = 50	EPE = 50	Total=100	**Duration of EPE**	:	
Revision:	:	Second			**Month**	:	June-21
Pre-requisites (if any)	:	Basics of Mechanical Engineering (ES-11A1)					
Course Domain	:	Professional Core					

Course Rationale:

Thermodynamics, science of the relationship between heat, work, temperature, and energy. Thermodynamics deals with the transfer of energy from one place to another and from one form to another. The key concept is that heat is a form of energy corresponding to a definite amount of mechanical work.

Course Objectives: The Course teacher will

1. To understand properties of fuels and lubricating oils.
2. To understand properties of grease.
3. To understand working of different types of water tube and fire tube boilers along with its accessories and mountings.
4. To understand working of different types of heat exchangers.

Course Outcomes: Students will be able to

1. Compute the properties of fuels & lubricating oils using suitable tests.
2. Explain properties of grease and measure penetration of grease.
3. Explain working, mountings and accessories of different types of boilers.
4. Explain working of different types of heat exchangers.

Sr. No	List of Experiment
1	Determination of flash and fire point of lubricating oil.
2	Experiment on Redwoods Viscometer.
3	Determination of penetration of grease.
4	Determination of dropping point of grease.
5	Determination of Aniline point.
6	Determination of Cloud and Pour Point.
7	Experiment on bomb calorimeter.
8	Study and Demonstration of water tube boiler (Babcock and Wilcox boiler)

9	Study and Demonstration of boiler mountings and accessories.
10	Study and Demonstration on heat exchangers.
11	Calibration of pressure gauges using dead weight pressure gauge.
12	Visit to an industry/sugar factory for study of cogeneration plant.

General Instructions: Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Reference Books:

1. "Basic and Applied Thermodynamics", P.K. Nag Tata McGraw-Hill Publishing Co. Ltd.
2. "Engineering Thermodynamics", R.K. Rajput, Laxmi Publication (P) Ltd. New Delhi
3. "Thermodynamics", Yunus Cengel and Michael Boles, McGraw-Hill Publishing Co. Ltd.
4. "Fundamentals of Thermodynamics", Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, John Wiley and Sons.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Laboratory Electrical Technology and C ++ Programming			**Course Code:**	**:**	ME 232P
Teaching Scheme (Hours)	**:**	Practical	2 Hrs/week		**Total Credits**	**:**	1
Evaluation Scheme (Marks)	**:**	IOE = 50	EPE = 00	Total=50	**Duration of EPE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.					
Course Domain	**:**	Professional Core					

Course Rationale:

ELECTRICAL TECHNOLOGY AND COMPUTER PROGRAMMING C++ subject belongs to the Applied Technology and Basic Technology group. This subject will develop the theory, concepts and operating principles of electrical machines, generators, alternators, different types of motors along with starting, switching and control circuits for the same, their applications. The knowledge acquired by the students will help them to design, test in electrical motors and generators.
ELECTRICAL TECHNOLOGY AND COMPUTER PROGRAMMING C++encourages students to learn concepts of programming, rules and syntax of 'C' language, arithmetic and logical operations in 'C' language, use of arrays, strings, functions, pointers, structures, unions and files in 'C' programming.

Course Objectives: The Course teacher will

1. Identify suitable motors for various industrial application.
2. Gain knowledge of significance of power factor and power factor correction method.
3. study of programming techniques developed in pre-requisite course, including use of object oriented programming, debugging, testing, coding standards and practices, memory management, optimization and software design principles
4. Gain the knowledge of various programming techniques.

Course Outcomes: Students will be able to

1 Apply the significance of and application of DC machines while addressing problems of mechanical engineering.
2 Apply the knowledge of power factor correction method.
3 Apply C++ features to program design and implementation.
4 Apply C++ to demonstrate practical experience in developing object oriented solutions.
5 Apply common software patterns in object-oriented design and recognize their applicability to other software development contexts.

Sr. No List of Experiment

Electrical Technology

1 Case study of any one industrial application
2 Speed control of DC Shunt Motor using a) Armature control and b) field control methods

3	To obtain Speed-Torque characteristics of DC Series Motor.
4	To obtain Speed-Torque characteristics of DC Shunt Motor.
5	Load test on D. C. Shunt motor.
6	To study different starters of three phase induction motor.;
7	To Study the effect of Inserting resistance on rotor of Slip ring induction motor.
8	To study various power factor improvement methods.

C ++ Programming

9	Minimum 1 program on Input/output and arithmetic expressions, hierarchy of operators, branching and loop control statements .
10	Minimum 1 program on pointers with Arrays and Function.
11	Minimum 2 programs on Class and Objects.
12	Minimum 2 programs on Inheritance .
13	Minimum 1 programs on Overloading.
14	Minimum 1 programs on Polymorphism.
15	Minimum 1 programs on file handling through class.

General Instructions:

1. Practical Journal Assessment, Internal Practical Examination.
2. Practical to be conducted alternate weeks. For Electrical Technology And computer Programming C++ Term work assessment consist of 25 marks for each Electrical Technology And computer Programming C++ separately.

Suggested Reference Books:

1. "Text of Electrical Technology ;Vol -2"; B. L. Theraja, and A. K. Theraja; S. Chand Publication
2. "Object Oriented Programming", E. Balguruswami, Tata McGraw Hill Publication.
3. "C++/CLI" Sivkumar wiely India
4. "Electrical machines" Ashfaq Hussain; Dhanpatrai and Co.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Laboratory Fluid Mechanics			**Course Code:**	**:**	ME 235P
Teaching Scheme (Hours)	**:**	Practical	2 Hrs/week		**Total Credits**	**:**	1
Evaluation Scheme (Marks)	**:**	IOE = NA	EPE = 50	Total=50	**Duration of EPE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.					
Course Domain	**:**	Professional Core					

Course Rationale:

Fluid Mechanics is core technology subject in mechanical engineering. Conversion of fluid energy in to mechanical energy and mechanical energy in to fluid energy, is the scope of subject fluid mechanics & fluid machines. As far as applications are concerned, areas like Industrial hydraulics & pneumatics, Tribology, Process equipment design, piping Engineering, Irrigation Engineering Requires basics of fluid mechanics. Content of fluid mechanics subject encourages students to become involved in learning of the principles of fluid mechanics at different levels such as-

- Understanding of concepts.
- The recognition of logical approach to problem solving.
- The ability to perform the details required in the solution.
- The ability to critique the design of given system & recommend improvements.

The ability to design practical, efficient fluid system.

Course Objectives: The Course teacher will

1. To measure pressure using manometers.
2. To distinguish between different types of flows.
3. To understand the calibration of notches, orifice and venturimeter.
4. To demonstrate major and minor losses.

Course Outcomes: Students will be able to

1. Work efficiently in a group, integrating skills and knowledge to make decisions in the performance of fluid mechanics tasks, adopting a responsible and organized attitude to work and a willingness to learn.
2. Apply the basic concepts of fluid mechanics to carry out professional engineering activities in the field of fluid and power plants.
3. Calibrate Venturimeter, Orificemeter and V-notch.
4. Measure pressure loss due to friction for pipe flow.

Sr. No	List of Experiment (Any Eight)
1	Determination of viscosity using redwood viscometer.

2	Study of manometers and the demonstration of the same in the laboratory.
3	Determination of metacentric height of a floating body.
4	Flow pattern development using electrical analogy method.
5	Calibration of venturimeter or orifice meter.
6	Visualization of laminar and turbulent flow in the Halleshaw apparatus.
7	Determination of friction factor for flow through pipe.
8	Verification of Bernoulli's Theorem.
9	Calibration of V- notch or rectangular notch.
10	Study of minor losses in the flow system.

General Instructions: Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Reference Books:

1	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Machine Drawing			**Course Code:**	**:**	ME 236
Teaching Scheme (Hours)	**:**	Practical	2 Hrs/week		**Total Credits**	**:**	2
Evaluation Scheme (Marks)	**:**	IOE = 00	EPE = 50	Total=50	**Duration of EPE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Lab.–II Engineering Graphics , ES-12A4 , ES-11B4					
Course Domain	**:**	Professional Core					

Course Rationale:

Machine drawing is a communicating medium employed in industries, to furnish all the information required for the manufacture and assembly of the components of a machine. Mechanical engineering students are required to practice the draughting standards as approved by International Organisation for Standards (ISO)

Course Objectives: The Course teacher will

1. To study the BIS conventions used in machine drawing.
2. To study the function of various machine components.
3. To study the concept of limit , fits and tolerances .
4. To study the details and assembly Drawings

Course Outcomes: Students will be able to

1. Identify the BIS conventions in part drawings and assembly drawing.
2. Sketch the various machine components.
3. Apply limits and tolerances to machine parts and choose appropriate fits.
4. Interpret given production drawings having surface roughness and tolerances.

Sr. No	List of Experiment
1	**Study of B.I.S. (Bureau of Indian Standards) Conventions:** Significance and importance of various BIS Conventions as per BIS- SP 46, Conventional representation of engineering materials, BIS conventions for sectioning, conventional representation of screw threads and threaded parts, Internal and external threads, conventional representation of springs, conventional representation of gears and gearings, conventional representation of common machine elements (splined shaft, serrated shaft, Knurling, bearings) Symbolic representation of Welds as per BIS conventions.
2	**Sketching of Machine Component:** Importance of sketching and entering proportionate dimensions on sketches. Sketches of nuts (square and Hexagonal), Flanged nuts, Lock nuts, Dome nut, Capstan nut, Wing nut, Castle nut, Split pin, etc. Sketches of bolt (square and hexagonal), Cup headed or round headed bolt, T-headed bolt, countersunk headed bolt, Hook bolt, Headless tapered bolt, Types of foundation bolts, Studs, Washer, Set screws, Cap screws. Muff coupling, Protected and unprotected Flanged coupling, Universal coupling
3	**Limits, Fits and Tolerances:**

	Significance of limit systems, terminology, Dimensional Tolerances, types of fits, Recommendations and selections, Geometric Tolerances, form and position, Representation of geometric tolerances on drawing
4	**Details and Assembly Drawing:** Assembly drawing from given detail drawing and vice versa with tolerances and fits. The number of parts is limited to ten to twelve. Preparation of detail and assembly drawing from the following details such as : Tool post, Tailstock, Machine vice, Chucks , Stuffing box, Crosshead assembly, Piston and connecting rod, Valve assembly, Screw jack, Jigs and fixtures, Pipe vice etc.

Term Work

1	Sheet No.1: Sheet Based on BIS conventions
2	Sheet No.2: Sketching of various machine components
3	Sheet No.3: Sheet Based on limits, Fits and tolerances
4	Sheet No.4: To draw details drawing from given assembly drawing
5	Sheet No.5: To draw assembly drawing from given details drawing

All these sheets should be drawn on half imperial (A2 size) drawing sheets.

General Instructions: Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Reference Books:

1	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Text Books:

1	"Machine Drawing", N. D. Bhatt & V. M. Panchal, Charotar Pub, Anand, Gujarat, 53rd edition, 2016
2	"A Textbook of Machine Drawing",P. S. Gill, S. K. Kataria & sons, New Delhi, 18th edition, 2014
3	"Machine Drawing",N. D. Junnarkar, Pearson Education, 2nd edition, 2006
4	"Machine Drawing"Dr. K. L. Narayana, Dr. P. Kannaiah, and K. Venkata Reddy, New Age International Publishers, New Delhi , 4th edition, 2016
5	"Machine Drawing" N. Sidheshwar . P. Kannaiah and V.V. S. Sastry. , Tata McGraw Hill, New Delhi.

Reference Books:

1	SP 46: 2003 Engineering Drawing Practice for Schools & Colleges, Published by Bureau of Indian Standards, Manak Bhavan, 9 Bhadur Shah Zafarmarg, New Delhi 2
2	IS: 696 Code of Practice for General Engineering Drawings B.I.S. Publications
3	IS : 2709 Guide for Selection of Fits, B.I.S. Publications
4	IS:919 Recommendation for Limits and Fits for Engineering, B.I.S. Publications
5	IS: 8000 Part I, II. III. TV, Geometrical Tolerencing of Technical Drawings B.I.S. Publications

Useful Links:

https://nptel.ac.in/courses/112/103/112103019/

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Workshop Practices I			**Course Code:**	**:**	ME 237
Teaching Scheme (Hours)	**:**	Practical	2 Hrs/week		**Total Credits**	**:**	1
Evaluation Scheme (Marks)	**:**	IPE = 50	EPE = 00	Total=50	**Duration of IPE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Laboratory work in basic mechanical Engineering, engineering graphics and work shop					
Course Domain	**:**	Professional Core					

Course Rationale:

By workshops based teaching and learning give the opportunities to perform hands-on practical trainings by observing or manipulating the theoretical knowledge to develop the understanding and appreciation

Course Objectives: The Course teacher will

1. To discuss various metal removal processes and machine tools.
2. To develop the skills about manufacturing aspects for any project work, as well as throughout his career.
3. To demonstrate the different tools used in various manufacturing operations such as machining on lathe.
4. To explain the various parts and working of lathe, drilling, milling, grinding machines.

Course Outcomes: Students will be able to

1. Understand various metal removal process and machine tools
2. Apply skills about manufacturing aspects for any project works as well as throughout his career
3. Calibrate and demonstrate the different tools used in various manufacturing operations
4. Measure the various parameters of lathe, drilling, milling, grinding machine.

Sr. No	**List of Experiment**
1	Preparation of pattern from component drawing, Pattern manufacturing after preparing pattern drawing.
2	Study of different types of forging processes and one job based on smithy/ forging.
3	Study of different types of welding processes and one job based on any one welding method.

General Instructions: Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Reference Books:

1 "Workshop Technology, Vol. II, III,and I",Chapman W.A. Edward Arnold Pub. Ltd. London

2 "Elements of Workshop Technology, Vol. Iand II", Hajra Chaudhary S.K. Media Prom and Pub, Mumbai.

3 "Manufacturing Processes for Engg. Materials" S. Klpakjim, S.R. Schmid Perason Education
4 "Fundamentals Of Modern Manufacturing", M.P.Groover Wiley India Pvt. Ltd.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Environmental Studies			**Course Code:**	**:**	HS 211
Teaching Scheme (Hours)	**:**	Lecture :	2 Hrs/week		**Total Credits**	**:**	--
		Tutorial :					
Evaluation Scheme (Marks)	**:**	Project 30	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Fourth			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Engineering Chemistry					
Course Domain	**:**	Humanities and Applied Science					

Course Rationale:

Course Objectives: The Course teacher will

1 To recall fundamental physical and biological principles those govern natural processes.
2 To understand the importance of ecological balance for sustainable development.
3 To Understanding the impacts of developmental activities and mitigation measures and to further understand the environmental policies and regulations.
4 To identify the complex relationships between scientific approaches to environmental issues and political, social, economic, and ethical perspectives on the environment.
5 To collect and interpret scientific data in both field and laboratory settings.
6 To integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.
7 To communicate scientific information to both professional and lay audiences.

Course Outcomes: Students will be able to

1 Develop an understanding of different natural resources including renewable resources.
2 Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3 Aware of important acts and laws in respect of environment.
4 Demonstrate critical thinking skills in relation to environmental affairs
5 Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.
6 Demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of environmental contexts.
7 Demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns.
8 Demonstrate an appreciation for need for sustainable development and role of science

Curriculum Content	Hours
Unit I Significance of environmental studies Multidisciplinary nature of environmental studies Need for public awareness. a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. b) Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. g) Role of an individual in conservation of natural resources. h) Equitable use of resources for sustainable lifestyle.	4
Unit II Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following Ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	4
Unit III Biodiversity and its Conservation Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.; Biodiversity at global, National and local levels.; India as a mega-diversity nation; Western Ghats as a bio-diversity region; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	4
Unit IV Environmental Pollution Definition: Causes, effects and control measures of: a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution, g) Nuclear hazards • Solid waste Management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution.• Pollution case studies• Disaster management: Floods, earthquake, cyclone and landslides. Tsunami	5
Unit V Social Issues and the Environment From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns; Environmental ethics: Issue and possible solutions; Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products.	5
Unit VI: Environmental Protection Environment Protection Act.; Air (Prevention and Control of Pollution) Act.; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Population Growth and Human Health, Human Rights. ;Field Work--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.	5

Suggested Text Books:

1 "Environmental Biology"Agarwal, K. C., Nidi Publ. Ltd., Bikaner.

2 "The Biodiversity of India" Bharucha Erach, Mapin Publishing Pvt. Ltd.

3 "Hazardous Waste Incineration" Brunner R. C., McGraw Hill Inc. 1989.

Suggested Reference Books:

1 Clark R. S., Marine Pollution, Clanderson Press Oxford

2 Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,

3 De A. K., Environmental Chemistry, Wiley Eastern Ltd.

4 Down to Earth, Centre for Science and Environment (R)

5 Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, III**					
Course Title	**:**	Introduction to Fine Arts			**Course Code:**	**:**	
Teaching Scheme (Hours)	**:**	Lecture :	2 Hrs/week		**Total Credits**	**:**	--
		Tutorial :					
Evaluation Scheme (Marks)	**:**	IPE = 0	EPE = 50	Grand Total= 50	**Duration of SEE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	In order to conduct the course successfully, student's involvement and interest in the classroom is the pre- requisite					
Course Domain	**:**	Humanity and Fine Arts					

Course Rationale:

Course Objectives: The Course teacher will

1. To understand the history of arts
2. To cultivate and enhance the interest in Music and other performing arts.
3. To highlight that these arts are not only the medium of entertainment but also a medium for proper channelization of emotions as this plays a vital role in determining the quality of life.
4. To form and defend value judgments about music.
5. To acquire audience skills such as listening and viewing responsibly.
6. To understand & develop skills to become lifelong learners in the musical art, both as participants and as audience members.

Course Outcomes: Students will be able to

1 Learn Fundamentals and types of Music and other allied arts.
2 Analyze, appreciate, and interpret significant works of art.
3 Demonstrate critical thinking through analysis and evaluation of works of art.
4 Develop good listening and viewing skills.
5 Understand the 'Gharana' system in Music.
6 Understand the classification of Musical instruments.
7 Demonstrate mastery of their designated area of concentration.
8 Demonstrate comprehension of global perspectives in visual culture.

Curriculum Content	**Hours**
Unit I	
Introduction to Music, Dance & Drama, History of Indian Music, Various Forms of Vocal Music.	4
Unit II	
History and introduction of Drama, Bharat muni natya shastra, street play, Sanskrit natya, Marathi sangit rangbhumi	4
Unit III	4

Dance, its type, greek and roman theatres,

Unit IV

Concept of Raga, Concept of Taal. 4

Unit V Curve Fitting and Regression

Notation System, Study of Gharana system in Music, Classification of Indian Instruments, Instrumental Music. 5

Unit VI

Contribution of Great Musicians, Appreciation of Music. Performance of a Music Concert. 5

General Instructions:

The students will be given six assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Suggested Text Books:

1 "Sangeet Visharad", Vasant, Sangeet Karyalaya, Hatras Prakashan.
2 "Sangeet Shastra Vigyan", Suchita Bidkar, Sanskar Prakashan.
3 "Sangeet Kala Aani Shikshan", Sudhir Mainkar, Sanskar Prakashan.
4 "Vadyavedh",Bhaskar Chandavarkar, Sanskar Prakashan.
5 "Tabla",Arvind Mulgaonkar, Popular Prakashan.
6 "All about theatre-Off stage" Chris Hogget.
7 "Understanding of Bharat Natyam" Mrinalini Sarabhai.
8 "Minding the body and mending the mind" Joan Borysenko.
9 "Ragadalli Antrang" V.K.Subbanna.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**					
Course Title	**:**	Applied Mathematics			**Course Code:**	**:**	ME 241
Teaching Scheme (Hours)	**:**	Lecture :	4 Hrs/week		**Total Credits**	**:**	5
		Tutorial :	1 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Basic knowledge of Engineering Mathematics-I and Engineering Mathematics-II.					
Course Domain	**:**	Basic Sciences					

Course Rationale:

This course offers a mathematical understanding for engineering applications. This course produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering.

Course Objectives: The Course teacher will

1. To describe solution of LDE and its applications in mechanical engineering.
2. To introduce Partial Differential Equations and its Applications.
3. To introduce Laplace Transform & Inverse Laplace transform and its Applications.
4. To explain Vector Differentiation and Vector Integration
5. The student must be able to formulate a mathematical model of a real life and engineering problem, solve and interpret the solution in real world.

Course Outcomes: Students will be able to

1. Solve Linear Differential Equations and Apply them to realistic problems.
2. Solve Partial Differential Equations for solving problems in Mechanical Engineering fields.
3. Understand Application of Laplace Transform in Mechanical Engineering
4. Apply knowledge of Vector Calculus to solve engineering problems.

Curriculum Content **Hours**

Unit I Linear Differential Equations

Linear Differential Equations with constant coefficients, Homogenous Linear differential equations, method of variation of parameters. 8

Unit II Applications of Linear Differential Equations

Applications of Linear Differential Equations with constant coefficients to Whirling of shafts and oscillations of a spring (Free oscillations, Damped oscillations, Forced oscillations without damping) 8

Unit III Partial Differential Equations

Four standard forms of partial differential equations of first order. 8

Unit IV Applications of Partial Differential Equations

Wave Equation, One and two dimensional heat flow equations, method of separation of variables, use of Fourier series. 8

Unit V Laplace Transform

Definition, L.T. of standard functions, Properties and theorems of Laplace transforms, Inverse L.T., Applications of L.T. to solve LDE (Initial value problems) 10

Unit VI: Vector Calculus

Vector Differentiation: Differentiation of vectors, Gradient of scalar point function, Directional derivative, Divergence of vector point function, Curl of a vector point function. Solenoidal, Irrotational and Conservative field. Vector Integration: The line integral, Surface integral, volume integral, Gauss's Divergence theorem, Stoke's theorem, Green's theorem (Without proof). 10

Suggested list of Tutorials and Assignments:

1. To find solution of LDE with constant coefficients
2. To find Solution of Homogeneous LDE
3. Applications of LDE
4. To find solution of PDE
5. Applications Of PDE
6. Laplace Transform
7. Applications of Laplace transform
8. Vector differentiation
9. Vector Integration

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches.
2. Students must be encouraged to solve numerical problems using different mathematical software's in tutorial class only.
3. Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 "Higher Engineering Mathematics", B.V. Ramana, Tata McGraw-Hill.
2 "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons.
3 "Engineering Mathematics", Veerarajan T., Tata McGraw-Hill, New Delhi

Suggested Reference Books:

1 "Advanced Engineering Mathematics", C. R. Wylie, McGraw Hill Publication, New Delhi.

2 "Higher Engineering Mathematics", B. S. Grewal, Khanna Publications, New Delhi.
3 "Engineering Mathematics (Volume-I)", S. S. Sastry, Prentice Hall Publication, New Delhi.
4 "Advanced Engineering Mathematics", H. K. Dass, S. Chand Publishing.
5 "A text book of Engineering Mathematics", N. P. Bali, Iyengar, Laxmi Publications (P) Ltd., New Delhi.
6 "Advanced Engineering Mathematics", Merle C. Potter, Oxford University Press, 3rd Edition
7 "Advanced Engineering Mathematics", M. D. Greenberg, Pearson Education.

<table>
<tr><td>Class, Part & Semester</td><td>:</td><td colspan="6">Second Year B. Tech (Mechanical Engineering), Part II, IV</td></tr>
<tr><td>Course Title</td><td>:</td><td colspan="3">Strength of Materials</td><td>Course Code:</td><td>:</td><td>ME 242</td></tr>
<tr><td rowspan="2">Teaching Scheme (Hours)</td><td rowspan="2">:</td><td>Lecture :</td><td colspan="2">4 Hrs/week</td><td rowspan="2">Total Credits</td><td rowspan="2">:</td><td rowspan="2">5</td></tr>
<tr><td>Tutorial :</td><td colspan="2">1 Hrs/week</td></tr>
<tr><td rowspan="2">Evaluation Scheme (Marks)</td><td rowspan="2">:</td><td>CIE=30</td><td rowspan="2">SEE = 70</td><td rowspan="2">Grand Total=100</td><td rowspan="2">Duration of SEE</td><td rowspan="2">:</td><td rowspan="2">3 hrs</td></tr>
<tr><td>(20+10)</td></tr>
<tr><td>Revision:</td><td>:</td><td colspan="3">Second</td><td>Month</td><td>:</td><td>Jun-21</td></tr>
<tr><td>Pre-requisites</td><td>:</td><td colspan="6" rowspan="2">Engineering Mechanics (ES-11A2)</td></tr>
<tr><td>(if any)</td><td></td></tr>
<tr><td>Course Domain</td><td>:</td><td colspan="6">Professional Core</td></tr>
</table>

Course Rationale:

Strength of materials is focused on analyzing stresses and deflections in materials under load. Knowledge of stresses and deflections allows for the safe design of structures that are capable of supporting their intended loads.

Course Objectives: The Course teacher will

1. Develop the theoretical basis about the stress, strain and elastic modulus concepts in various components.
2. To familiarize about finding shear force, bending moment, deflection and slopes in various types of beams with different load conditions.
3. To enable students to solve practical problems related to shafts & springs.
4. To enable students to solve practical problems related to Pressure Vessel.

Course Outcomes: Students will be able to

1. Explain basic laws, relationship between elastic constants, principal stress and principal planes.
2. Solve the problems related to Shear force, bending moment, deflection and slope in various types of beams.
3. Solve the practical problems related to shafts and springs.
4. Solve practical problems and design thin cylinders, Spherical Shell.

Curriculum Content	Hours
Unit I Simple stresses and strains Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains Principal stresses and principal planes – Mohr's Circle	10
Unit II **a) Shear force and bending moment diagrams** Concept and definition of shear force and Bending Moment in beams due to Point load, UDL, UVL. Construction of SF, and BM diagrams for cantilevers, simply support beam. **b) Bending Stresses in beams** Theory of simple bending, concept and assumptions, Derivation of Flexure formula. Bending stress distribution diagram. Moment of resistance and section modules calculations. Design of rectangular and circular (solid and hollow) sections: L, I and T sections Shear stress , Shear stresses concept, shear stress distribution diagram for common symmetrical sections such as : circular, I, and T	10
Unit III **a) Axially loaded columns.** Concept of critical load and buckling, Euler's formulae for different end connections, concept of equivalent length for various end conditions. Rankin's formulae, safe load on column, Limitations of Euler's formulae. **b) Strain energy and impact.** Concept of strain energy, derivation and use of expressions for deformation of axially loaded members under gradual sudden and impact loads.	8
Unit IV Slope and Deflection Concept and definition, relation between B.M., slope and deflection, Solution of beam for slope and deflection by double integration method (McCauley's method) (Simply supported beam and cantilever beam)	8
Unit V Torsion of circular shaft Torsion, stresses and deformation in circular and hollow shafts, Basic assumptions, Derivation of torsion formulae, Stresses and deflection of helical springs.	6
Unit VI: Pressure Vessels. Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thin cylinders, deformation in spherical shells subjected to internal pressure	6

Suggested list of Tutorials and Assignments:

Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 "Strength of Materials", R Subramanian, Oxford University Press
2 "Strength of Materials", R.K. Rajput, Laxmi Publications Pvt. Ltd. New Delhi
3 "Strength of Materials", Dr. R.K. Bansal, Laxmi Publications
4 "Mechanics of Materials", R.C. Hibbeler , PEARSON Publication

Suggested Reference Books:

1 "Mechanics of Material", Gere &Timoshenko, CSB Publisher 1984.
2 "Introduction to Mechanics of solids", E.P. Pov, Prentice Hall Publication.
3 "Strength of Materials", Singer and Pytel , Harper and Row Publications.
4 "Strength of Materials", Timoshenko and Young , CSB Publisher
5 "Strength of Materials", G.H. Rider, Mac Millan India Ltd

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**					
Course Title	**:**	Theory of Machines – I			**Course Code:**	**:**	ME 243
Teaching Scheme (Hours)	**:**	Lecture :	4 Hrs/week		**Total Credits**	**:**	4
		Tutorial :					
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Basic Physics, Engineering Mathematics, Engineering Mechanics					
Course Domain	**:**	Professional Core					

Course Rationale:

Course Objectives: The Course teacher will

1. Make the student familiar with commonly used mechanism for industrial application.
2. Develop competency in drawing velocity and acceleration diagram for simple and complex mechanism
3. Develop an ability to design gear drive and cam profile for given application
4. Impart the knowledge of working of flywheel, belt drives and friction surface.

Course Outcomes: Students will be able to

1. Identify mechanism that should be used according to application and find the degree of freedom of different mechanism.
2. Demonstrate the kinematics of cams and followers, flywheel and their characteristics and also design cams and followers for specified motion profiles.
3. Differentiate between types of gears and to analyse the characteristics of meshing gears
4. Select different power transmitting elements according to application.

Curriculum Content	**Hours**
Unit I Basic Kinematics	
Structure, Machine, Link and its types Kinematics pair -Lower pair and higher pair, Form closed pair and force closed pairs, Based on relative motion permitted such as revolute, prismatic, cam, helical, globular. **Kinematics chain and Mechanisms:** Grublers criterion for movability of chains and mechanisms, Limitations of Grublers Criteria.	10

Inversion of chain: Study of various mechanisms derived from inversions of following Four bar chain (Grashoffian, and non-Grashoffian), Single slider crank chain, and Double slider crank chain

Exact Straight line generating Mechanism Peaucellier and Harts

Approximate straight line generating Mechanisms Watts, Roberts, Evans and Chebyshev,

Offset slider crank mechanisms Pantograph, Hook joint single and Steering gear mechanisms – Ackerman, Davis.

Unit II Mechanical Power Transmitting and Storing Devices

Belt Drive- Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt, V Belts, Selection of Belts. [Numerical Treatment on flat belt only] 8

Flywheel- Turning moment diagrams, Fluctuation of energy, Coefficient of fluctuation of speed, Rimmed flywheel [Only Theoretical treatment for Flywheel]

Unit III Gear and Gear Train

Gears-Introduction, types, Law of gearing, Construction of Involute and Cycloid gear tooth profile, Details of gear terminology, involutes and cycloidal tooth profile, Interference in involutes gears, Critical numbers of teeth for interference free motion Methods to control interference in involutes gears. 8

Helical Gears- Nomenclatures, center distance, **Spiral Gears-** Center distance, efficiency.

Gear Trains: Kinematics and dynamic analysis of simple and compound gear trains, reverted gear trains, epi-cycle gear trains with spur gear combination

Unit IV Cams and Followers

Classification of cams, Classification of followers, Terminologies of cam and follower, Motions of Follower a) Uniform velocity b) Simple harmonic motion c) Uniform acceleration and retardation d) Cycloidal motions, Displacement diagram of follower, Velocity and acceleration diagram of Follower, Construction of cam profile 8

Unit V Velocity and Acceleration Analysis in Mechanism

Graphical analysis- velocity and acceleration for different mechanisms using relative velocity and acceleration method, Corioli's component of acceleration (Simple Problems), Klein's construction for slider crank mechanism, Instantaneous centre method (Up to 6 IC), Kennedy's theorem. 8

Analytical analysis- Approximate analytical method for velocity and acceleration of piston

Unit VI Surface Contacts

Introduction of friction, Friction in pivot bearings, Inclined plane theory, Friction circle 6

Suggested list of Tutorials and Assignments:

Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 "Theory of Machines" Ratan S.S Tata McGraw Hill New Delhi.
2 "Theory of Machines" P.L.Ballany Khanna Publication, New Delhi
3 "Theory of Machines "V.P. Singh Dhanpat Rai and Sons
4 "Theory of machines" Dr. R. K. Bansal Laxmi Publication

Suggested Reference Books:

1 "Theory of Machines" Thomas Bevan CBS Publishers, New Delhi.
2 "Theory of Machines and Mechanism" Shigley Oxford International
3 "Theory of mechanism and machines" Sadhu Singh Pearson
4 "Theory of machines and Mechanism" Jagdish Lal Metropolitin Book Company
5 "Mechanism and Machines" Gosh And Mallik East West Press
6 "Theory of Machine" Sarkar Tata Mc Graw Hill

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**					
Course Title	**:**	Fluid and Turbo Machinery			**Course Code:**	**:**	ME 244
Teaching Scheme (Hours)	**:**	Lecture :	3 Hrs/week		**Total Credits**	**:**	3
		Tutorial :					
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	In order to complete the course studies successfully, it is important to have a good command of English, Engineering Physics, Chemistry-I, Chemical Engineering Thermodynamics-I and Fluid Flow Operations.					
Course Domain	**:**	Professional Core					

Course Rationale:

Fluid and turbo Machinery is core technology subject in mechanical engineering. Conversion of fluid energy in to mechanical energy and mechanical energy in to fluid energy, is the scope of subject fluid mechanics & fluid machines. As far as applications are concerned, areas like Industrial hydraulics & pneumatics, Tribology, Process equipment design, piping Engineering, Irrigation Engineering Requires basics of fluid mechanics. Content of fluid mechanics subject encourages students to become involved in learning of the principles of fluid mechanics at different levels such as-

- Understanding of concepts.
- The recognition of logical approach to problem solving.
- The ability to perform the details required in the solution.
- The ability to critique the design of given system & recommend improvements.
- The ability to design practical, efficient fluid system.

Course Objectives: The Course teacher will

1. To understand impulse momentum principle and its applications
2. To learn the working principles of impulse and reaction water turbines.
3. To illustrate the concept of different types of pumps and compressor.
4. Train the students to acquire the knowledge and skill of analyzing different turbo machines

Course Outcomes: Students will be able to

1. To design and calculate different parameters for turbo machines.
2. To understand thermodynamics and kinematics behind turbo machines.

3. To formulate design criteria.
4. To understand the concept of centrifugal and axial compressors.

Curriculum Content	Hours
Unit I Impulse Water Turbines Introduction to turbo machinery, Classifications, Machines classification of water turbines, Pelton wheel, its construction and working, velocity triangles. Pelton wheel design bucket dimensions, number of buckets, jet diameter, wheel diameter, jet ratio, speed ratio, number of jets, calculation of efficiency, power, discharge etc. Governing of Pelton wheel. **(Note: The chapter includes numerical treatment on the appropriate topics.)**	10
Unit II Reaction Water Turbines Principle of operation, construction and working of Francis and Kaplan Turbine, effect of modification of velocity triangles on runner shape, draft tube, calculation of various efficiencies, power, discharge, blade angles, runner dimensions etc. Governing of Francis and Kaplan turbine. Draft tube-types and analysis. **(Note: The chapter includes numerical treatment on the appropriate topics.)**	14
Unit III Centrifugal Pumps Working principles, Construction, various heads, multistage pumps, velocity triangles, minimum starting speed, cavitation, MPSH and NPSH. Methods of priming calculations of efficiencies, discharge, blade angles, head, power required, impeller dimensions etc. **(Note: The chapter includes numerical treatment on the appropriate topics.)**	7
Unit IV Similarity Principles Model testing, unit quantities, Specific speed of turbine (Pelton wheel, Francis turbine, Kaplan turbine), specific speed of pumps. Prediction of performance at other operating conditions. Performance characteristics of Turbines and pumps. **(Note: The chapter includes numerical treatment on the appropriate topics.)**	7
Unit V Air compressors Application of compressed air , classification of compressor, reciprocating compressors, construction , work input, necessity of cooling , isothermal efficiency, heat rejected, effect of clearance volume, volumetric efficiency, necessity of multi staging, construction, optimum intermediate pressure for minimum work required, after cooler, Roots blower and vane blower (descriptive treatment) **(Note: The chapter includes numerical treatment on the appropriate topics.)**	7
Unit VI Rotodyanamic Air Compressors Centrifugal compressor- velocity diagram, pre whirl, slip factor, performance calculations. Axial flow compressors- velocity diagram, degree of reaction, polytropic efficiency, surging, chocking, stalling, performance, comparison with centrifugal. **(Note: The chapter includes numerical treatment on the appropriate topics.)**	7

Suggested list of Tutorials and Assignments:
Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1. "Fluid Mechanics & Hydraulic Machines", Dr. R.K. Bansal, Laxmi Publications LTD, revised 9th Edition
2. "Steam and gas Turbines", R. Yadav, Central Publishing House, Allahabad, 6th Edition , 1997 .
3. "Gas Turbines", V. Ganeshan, Published by TMH Education Pvt. Ltd. , 3rd Edition.
4. "Thermal Engg.", Kumar vasantdani, Khanna publisher
5. "Thermal Engg.",P.L. Balleny, Khannapublisher. , 20th Edition

Suggested Reference Books:

1. "Hydraulic Machines" V.P. Vasantdani
2. "Fluid flow machines" N.S. Govindrao
3. "Turbo machines" S.M. Yahya
4. "Fluid power Engineering" D.S. Kumar
5. "Steam and gas Turbines" R. Yadav
6. "Fluid Mechanics",White McGraw Hill Publication
7. "Advanced Fluid Engineering",Murlidhar, Narosa Publication.
8. "Fundamentals of fluid mechanics",G.S.Sawhney I.K. International Publishing House Pvt. Limited, New-Delhi, 2008 New York.
9. "Mechanics of Fluid",Irving Shames McGraw Hill Publication

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**				
Course Title	**:**	Metallurgy		**Course Code:**	**:**	ME 245
Teaching Scheme (Hours)	**:**	Lecture :	4 Hrs/week	**Total Credits**	**:**	4
		Tutorial :				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	**Duration of SEE**	**:** 3 hrs
Revision:	**:**	Second		**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include Engineering Physics, Engineering Chemistry, Manufacturing Engineering - I				
Course Domain	**:**	Professional Core				

Course Rationale:

This course provides students to understand the basic structure and crystal arrangement of materials, the phase diagrams, advantages of heat treatment and the method of heat treatment processes, the need and application of powder metallurgy processes

Course Objectives: The Course teacher will

1. Acquaint students with the basic concepts of metal structure
2. Impart fundamental knowledge of ferrous and non-ferrous metal processing
3. Study the various heat treatment processes for different metals and alloys
4. Analyse and select various class of materials for specific applications.

Course Outcomes: Students will be able to

1. Understand basic concept of metal structure.
2. Understand phase diagrams and heat treatments for ferrous and non-ferrous materials.
3. Understand the need of various heat treatment processes.
4. Evaluate the mechanical properties of materials for specific applications.

Curriculum Content	**Hours**
Unit I Metals and Alloy Systems	14

Introduction to Metallic and Non-metallic materials and its classification (metals/alloys, polymers and composites)

1. Metals, Metallic bonds, Crystal structure (SC, BCC, FCC, HCP), Imperfections in crystals, Miller indices , indexing of lattice planes & directions, Lattice parameters (coordination number, no. of atoms per unit cell, atomic packing factor, density)
2. Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring. Concept of solidification of pure metals & alloys, Nucleation : homogeneous and heterogeneous Cooling curves, Plotting of Equilibrium diagrams, Lever rule
3. Solid solutions and intermediate phases, Hume Ruthery's rule of solid solubility
4. Phases and Gibbs phase rule
5. Construction of equilibrium diagrams from cooling curves, Isomorphous system (Solid Solution), Eutectic, Partial solubility Peritectic and Intermetallic Compounds Lever arm principles.

Unit II Study of Phase Diagrams

(With respect to typical compositions, Properties and Applications for the following alloys.)

1. Fe- Fe3C equilibrium diagram - Ferrous alloys (Plain carbon steels, cast iron)
2. Alloy steels- Free cutting steels, HSLA high carbon low alloy steels, maraging steels, creep resisting steels, Stainless steels- different types. Tool steels- types, 10
3. Selection of materials and Specifications based on -IS, BS, SAE, AISI,
4. Copper based alloys brasses Cu- Zn, Bronzes Cu- Sn, Cu- Be, and Cu-Ni.
5. Aluminium based alloys Al- Cu(Duralumin) - Al-Si (Modification),
6. Pb- Sn(Solders and fusible alloys)
7. Sn-Sb alloys (Babbits)

Unit III Principles of Heat Treatment

1. Transformation of Pearlite into austenite upon heating,
2. Transformation of austenite into Pearlite, Bainite and Martensite on cooling.
3. TTT –Diagram and CCT - Diagrams - significance, Effect of alloying elements on TTT diagram and its significance. 7
4. Heat treatment furnaces and equipment, controlled atmosphere.

Unit IV Heat Treatment Processes

a) Heat Treatment of Steels

1. Annealing – Types-Full, Partial and Sub critical annealing (Various types) and purposes
2. Normalising- Purposes 10
3. Hardening (Hardening types), Purposes, Austempering and Martempering, Mechanism of quenching and Quenching media, Hardenability- Concept and methods of determination of hardenability- Grossmans critical diameter method and Jominy end quench test.

4. Tempering Types, Structural transformations during tempering, purposes sub zero treatment
5. Surface hardening - Flame and Induction
6. Chemical heat treatments for case hardening - Carburising, Nitriding, Cyniding, Carbonitriding

b) Heat treatment of Non-ferrous Alloys

1. Annealing- Stress relief, Recrystallization and Process annealing
2. Precipitation hardening - Basic requirements, Stages, Common alloys, Variables, Theories

c) Heat treatment defects and remedies

Unit V Principles of Mechanical Testing

Principles of Mechanical Testing:

1. Destructive Testing methods: Tensile, Compressive, Impact, Fatigue, Creep Hardness(Rockwell, Brinell and Vickers)
2. Non- Destructive Testing: Dye Penetrant, Magnetic, Ultrasonic, Radiography, Eddy Current testing

7

Unit VI: Powder Metallurgy

1. Advantages, Limitations and Applications of Powder Metallurgy
2. Powder manufacturing types- Mechanical, Physical, Chemical and Electro- Chemical
3. Mixing/ Blending- (Double cone and Y- Cone mixers)
4. Compaction- types- Conventional, Isostatic, HERF, Powder rolling and extrusion
5. Sintering- Types liquid stage and solid stage sintering
6. Finishing operations: Sizing, Machining, Infiltration and Impregnation

7

Suggested list of Tutorials and Assignments:

Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 "Introduction to physical metallurgy", S.H.Avner, Mcgraw Hill Book Company Inc, Edition, 2nd, 1974.

2 "Physical metallurgy",Vijendrasingh, Standard Publishers delhi

3 "Material science and engineering", W. D Callister, Wiley India Pvt. Ltd., 5th Edition.

4 "Heat Treatments Principles and Practices", T.V. Rajan / C.P. Sharma, Prentice Hall of India Pvt Ltd, New Delhi,

5 "Material Science and Engineering", V Raghwan, Prentice Hall of India Pvt. Ltd., New Delhi , 3rd Edition, 1995.

Suggested Reference Books:

1 "Engineering Metallurgy", R.A. Higgins, Viva Books Pvt. Ltd., New Delhi, 1st Edition ,1998

2 "Physical Metallurgy for Engineers ", D.S.Clark, W. R. Varney, AN East West Press Pvt. Ltd. , New Delhi, 2nd Edition,1962

3 "Heat Treatment of Metals", J L Smith and SC Bhatia , CBS Publishers and distributors, New Delhi, 1st edition, 2008.

4 "Heat treatment of Steels" Prabhudev, HMT Handbook

5 G.E. Dieter, Mechanical Metallurgy, Tata McGraw-Hill, New Delhi.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**					
Course Title	**:**	Laboratory Theory of Machines - I			**Course Code:**	**:**	ME 243P
Teaching Scheme (Hours)	**:**	Practical	2 Hrs/week		**Total Credits**	**:**	1
Evaluation Scheme (Marks)	**:**	IOE =00	EOE = 50	Total=50	**Duration of EPE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Theory of Machine, Applied Mechanics					
Course Domain	**:**	Professional Core					

Course Objectives: The Course teacher will

1. Determine slip and angular velocities.
2. Distinguish between different types of mechanism and machine.
3. Understand the Inversion of kinematic chain, limiting position and dead position.
4. Demonstrate of x-t, v-t, a-t, curves of follower motions.

Course Outcomes: Students will be able to

1. Calibrate slip and angular velocities.
2. Illustrate different types of mechanism and machine.
3. Apply the inversion of kinematic chain, limiting position and dead position
4. Calibrate of x-t, v-t, a-t, curves of follower motions.

Sr. No	**List of Experiment (Any Eight)**
1	Inversion of kinematic chain, limiting position and dead position
2	Location of instant center, Velocity analysis by ICR
3	Velocity and acceleration analysis by relative method.
4	Construction of cam profile.
5	Construction of x-t, v-t, a-t, curves of follower motions
6	To generate gear tooth profile and to study the effect of under cutting and rack shift using model.

7	Numerical Problems on gear and gear train
8	Verification of ratio of angular velocities of shafts connected by Hooks joint.
9	To determine the belt slip
10	To study frictional properties of clutch/brake lining and to determine experimentally torque carrying capacity and slip of the clutch or brake.
11	To determine the coefficient of friction and wear of a given material.
12	Study of mechanical/transmission type dynamometer.
13	Simulation of motions of mechanism using CAD package

General Instructions: Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Reference Books:

1. "Theory of Machines" Ratan S.S Tata McGraw Hill New Delhi.
2. "Theory of Machines" P.L.Ballany Khanna Publication, New Delhi
3. "Theory of Machines" V.P. Singh Dhanpat Rai and Sons
4. "Theory of machines" Dr. R. K. Bansal Laxmi Publication
5. "Theory of Machines" Thomas Bevan CBS Publishers, New Delhi.
6. "Theory of Machines and Mechanism" Shigley Oxford International
7. "Theory of mechanism and machines" Sadhu Singh Pearson
8. "Theory of machines and Mechanism" Jagdish Lal Metropolitin Book Company
9. "Mechanism and Machines" Gosh And Mallik East West Press
10. "Theory of Machine" Sarkar Tata Mc Graw Hill

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**					
Course Title	**:**	Laboratory Fluid and Turbo Machinery			**Course Code:**	**:**	ME 244P
Teaching Scheme (Hours)	**:**	Practical	2 Hrs/week		**Total Credits**	**:**	1
Evaluation Scheme (Marks)	**:**	IPE = 50	EPE = 50	Total=100	**Duration of EPE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.					
Course Domain	**:**	Professional Core					

Course Rationale:

Fluid and turbo Machinery is core technology subject in mechanical engineering. Conversion of fluid energy in to mechanical energy and mechanical energy in to fluid energy, is the scope of subject fluid mechanics & fluid machines. As far as applications are concerned, areas like Industrial hydraulics & pneumatics, Tribology, Process equipment design, piping Engineering, Irrigation Engineering Requires basics of fluid mechanics. Content of fluid mechanics subject encourages students to become involved in learning of the principles of fluid mechanics at different levels such as-

- Understanding of concepts.
- The recognition of logical approach to problem solving.
- The ability to perform the details required in the solution.
- The ability to critique the design of given system & recommend improvements.

The ability to design practical, efficient fluid system.

Course Objectives: The Course teacher will

1. To describe the main / operating characteristics of turbines and pumps.
2. To explain the working of reciprocating compressor.
3. To distinguish between different hydraulic devices.
4. To distinguish between different types of pumps.

Course Outcomes: Students will be able to

1. Conduct trial and Calculate performance parameters of different turbomachinery.
2. Draw and compare performance characteristics curves with their theoretical nature of different turbomachinery.
3. Explain construction and working of different types of pumps.

4. Explain construction and working of various hydraulic devices.

Sr. No	List of Experiment (Any Seven)
1	Study and trial on Pelton wheel.
2	Study and trial on Francis/ Kaplan turbine
3	Trial on Centrifugal pump
4	Study and demonstration of reciprocating pump and hydraulic ram
5	Study and trial on reciprocating compressor
6	Study and trial on centrifugal blower
7	Study of hydraulic devices- Intensifier, Accumulator, Hydraulic jacks, press, Crane.
8	Study of other types of pumps- Gear pump, Jet pump, submersible pump, air lift pump
9	Industrial visit or hydro power plant visit
10	Study of minor losses in the flow system.

General Instructions: Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Reference Books:

1 Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**					
Course Title	**:**	Laboratory Metallurgy			**Course Code:**	**:**	ME 245P
Teaching Scheme (Hours)	**:**	Practical	2 Hrs/week		**Total Credits**	**:**	1
Evaluation Scheme (Marks)	**:**	IPE = 50	EOE = 50	Total=100	**Duration of EOE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.					
Course Domain	**:**	Professional Core					

Course Rationale:

This course provides students to understand the basic structure and crystal arrangement of materials, the phase diagrams, advantages of heat treatment and the method of heat treatment processes, the need and application of powder metallurgy processes.

Course Objectives: The Course teacher will

1. To evaluate mechanical properties through destructive testing.
2. To understand different heat treatment processes and hardenability test.
3. To understand non-destructive testing methodsand failure analysis.
4. To understand micro structural details of ferrous and non-ferrous materials.

Course Outcomes: Students will be able to

1. Interpret properties on stress-strain diagram and select different hardness machine as per requirement.
2. Set process parameters for different heat treatment processes.
3. Select different NDT methods, depending on types of defects.
4. Understand micro structural details drawing of ferrous and non-ferrous materials.

Sr. No	**List of Experiment**
1	Study of effect of a heat treatment process on tensile strength of a sample, e.g. Mild steel.
2	Study of effect of a heat treatment process on hardness of a test sample, e.g. Mild steel.
3	Study of effect of a heat treatment process on Impact strength of a test sample, e.g. Mild Steel.

4 Study of Non-Destructive tests: Magnaflux testing, Dye penetrant testing and Ultrasonic testing.
5 Study and drawing of microstructures of mild steel, medium carbon steel, eutectoid steel and hypereutectoid steel.
6 Study and drawing of microstructures of brass. Tin bronze, Al-bronze, Babbit metal.
7 Study and drawing of microstructures of white malleable, gray and nodular cast irons.
8 Study and drawing of microstructures of hardened steel, tempered steel.

General Instructions: Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Reference Books:

1 "Physical metallurgy", Vijendrasingh, Standard Publishers delhi
2 "Heat Treatment of Metals", J L Smith and SC Bhatia , CBS Publishers and distributors, New Delhi, 1st edition, 2008.
3 "Material Science and Engineering",VRaghwan., Prentice Hall of India Pvt. Ltd., New Delhi ,3rd Edition, 1995.
4 "Material science and metallurgy for engineers",V.D. Kodgire, Everest Publishers Pune,12th Edition

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**					
Course Title	**:**	Workshop Practices I			**Course Code:**	**:**	ME 246
Teaching Scheme (Hours)	**:**	Practical	2 Hrs/week		**Total Credits**	**:**	1
Evaluation Scheme (Marks)	**:**	IPE = 50	EPE = 100	Total=150	**Duration of IPE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	Laboratory work in Engineering Physics, Chemistry-I and Fluid Flow Operations.					
Course Domain	**:**	Professional Core					

Course Rationale:

This course provides students to understand the basic structure and crystal arrangement of materials, the phase diagrams, advantages of heat treatment and the method of heat treatment processes, the need and application of powder metallurgy processes.

Course Objectives: The Course teacher will

1. To explain pattern and its types, material used, allowances.
2. To apply their skills for manufacturing the pattern from the given drawing.
3. To characterize the sand based on various properties, to enhance the skills in operations like pattern making, moulding.
4. To use machining skills to fabricate a job on various machining tools

Course Outcomes: Students will be able to

1. Conduct test on sand for size analysis, grain fineness number, hardness, permeability, moisture percentage, clay content etc.
2. Identify the practical difficulties encountered in the process of sand testing and mould making.
3. Explain types, allowances and construction of pattern and core.
4. Use machining skills to fabricate a job on various machining tools.

Sr. No	**List of Experiment**
1	Demonstration of various hand tools used in workshop
2	Visit to a factory to study the various foundry and foundry related operations
3	Fabrication of a job involving turning, drilling, milling and welding (One or two jobs)

General Instructions: Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Reference Books:

1. "Workshop Technology, Vol. II, III,and I",Chapman W.A. Edward Arnold Pub. Ltd. London
2. "Elements of Workshop Technology, Vol. Iand II", Hajra Chaudhary S.K. Media Prom and Pub, Mumbai.
3. "Manufacturing Processes for Engg. Materials" S..Klpakjim, S.R. Schmid Perason Education
4. "Fundamentals Of Modern Manufacturing", M.P.Groover Wiley India Pvt. Ltd.

<table>
<tr><td>Class, Part & Semester</td><td>:</td><td colspan="5">Second Year B. Tech (Mechanical Engineering), Part II, IV</td></tr>
<tr><td>Course Title</td><td>:</td><td colspan="3">Environmental Studies</td><td>Course Code:</td><td>:</td><td>HS 211</td></tr>
<tr><td rowspan="2">Teaching Scheme (Hours)</td><td rowspan="2">:</td><td>Lecture :</td><td colspan="2">2 Hrs/week</td><td rowspan="2">Total Credits</td><td rowspan="2">:</td><td rowspan="2">--</td></tr>
<tr><td>Tutorial :</td><td colspan="2"></td></tr>
<tr><td>Evaluation Scheme (Marks)</td><td>:</td><td>Project
30</td><td>SEE = 70</td><td>Grand Total=100</td><td>Duration of SEE</td><td>:</td><td>3 hrs</td></tr>
<tr><td>Revision:</td><td>:</td><td colspan="3">Fourth</td><td>Month</td><td>:</td><td>Jun-21</td></tr>
<tr><td>Pre-requisites (if any)</td><td>:</td><td colspan="6">Engineering Chemistry</td></tr>
<tr><td>Course Domain</td><td>:</td><td colspan="6">Humanities and Applied Science</td></tr>
</table>

Course Rationale:

Course Objectives: The Course teacher will

1. To recall fundamental physical and biological principles those govern natural processes.
2. To understand the importance of ecological balance for sustainable development.
3. To Understanding the impacts of developmental activities and mitigation measures and to further understand the environmental policies and regulations.
4. To identify the complex relationships between scientific approaches to environmental issues and political, social, economic, and ethical perspectives on the environment.
5. To collect and interpret scientific data in both field and laboratory settings.
6. To integrate and apply perspectives from across the natural sciences, social sciences, and the humanities in the context of complex environmental problems.
7. To communicate scientific information to both professional and lay audiences.

Course Outcomes: Students will be able to

1. Develop an understanding of different natural resources including renewable resources.
2. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. Aware of important acts and laws in respect of environment.
4. Demonstrate critical thinking skills in relation to environmental affairs
5. Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.
6. Demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of environmental contexts.
7. Demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns.
8. Demonstrate an appreciation for need for sustainable development and role of science

Curriculum Content	Hours
Unit I Significance of environmental studies Multidisciplinary nature of environmental studies Need for public awareness. a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. b) Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. g) Role of an individual in conservation of natural resources. h) Equitable use of resources for sustainable lifestyle.	4
Unit II Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following Ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	4
Unit III Biodiversity and its Conservation Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.; Biodiversity at global, National and local levels.; India as a mega-diversity nation; Western Ghats as a bio-diversity region; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	4
Unit IV Environmental Pollution Definition: Causes, effects and control measures of: a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution, g) Nuclear hazards • Solid waste Management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution.• Pollution case studies• Disaster management: Floods, earthquake, cyclone and landslides. Tsunami	5
Unit V Social Issues and the Environment From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns; Environmental ethics: Issue and possible solutions; Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products.	5
Unit VI: Environmental Protection	5

Environment Protection Act.; Air (Prevention and Control of Pollution) Act.; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Population Growth and Human Health, Human Rights. ;Field Work--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.

Suggested Text Books:

1 "Environmental Biology"Agarwal, K. C., Nidi Publ. Ltd., Bikaner.
2 "The Biodiversity of India" Bharucha Erach, Mapin Publishing Pvt. Ltd.
3 "Hazardous Waste Incineration" Brunner R. C., McGraw Hill Inc. 1989.

Suggested Reference Books:

1 Clark R. S., Marine Pollution, Clanderson Press Oxford
2 Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
3 De A. K., Environmental Chemistry, Wiley Eastern Ltd.
4 Down to Earth, Centre for Science and Environment (R)
5 Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press

Class, Part & Semester	**:**	**Second Year B. Tech (Mechanical Engineering), Part II, IV**					
Course Title	**:**	Soft Skills Development			**Course Code:**	**:**	HS 222
Teaching Scheme (Hours)	**:**	Lecture :	2 Hrs/week		**Total Credits**	**:**	--
		Practical:					
Evaluation Scheme (Marks)	**:**				**Duration of SEE**	**:**	
Revision:	**:**	Second			**Month**	**:**	Jun-21
Pre-requisites (if any)	**:**	H.S.C level English Language Competency					
Course Domain	**:**	Humanity and Fine Arts					

Course Objectives: The Course teacher will

1. To develop effective communication skills (spoken and written).
2. To develop effective presentation skills.
3. To compete successfully in the business environment.
4. To generate ability in the learners to put their domain knowledge into effective practice.
5. To make the students self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.
6. To prepare the learners to take part effectively in various selection procedures adopted by the recruiters and to increase employment opportunities

Course Outcomes: Students will be able to

1	Students are able to expertise in self-development, effective communication skills and interview skills
2	Understand how to handle situation and take decision
3	Equip to any sort of interviews particularly job interviews
4	Acquaintance with documentation skills
5	Become self-reliant and responsible
6	Team build up, its development and management
7	Demonstrate mastery of their designated area of concentration.

Curriculum Content	**Hours**
Unit I Self-Development	
Introduction to Music, Dance & Drama, History of Indian Music, Various Forms of Vocal Music.	2

Unit II Effective Communication Skills

Importance of communication, Communication process, Elements of communication, Communication Types-verbal and nonverbal, objectives of communication. Business Communication, current English usage, debates, language games, situational dialogues, precise writing, essay writing, presentations. — 6

Unit III Behavioural Skills

Psychological Tests: Aptitude and personality assessment, suggestions for improvement,
Team Skills: Team building and leadership, evolution of groups into teams, group dynamics, emergence of leadership, intra-group dynamics, inter-group dynamics, conflict management, inter dependency, assessment of team-based projects,
Time Management: Pareto's Principle, Parkinson's Laws, Murphy's Laws, Law of Clutter, prioritization, goal setting, effective time management, — 8
Interpersonal Skills: Negotiations, listening skills, social skills, assertive skills, cross-cultural communications,
Leadership Skills: Concepts of leadership, leadership styles, insights from great leaders.

Unit IV Documentation

Report writing-Formal report, study tour report, project report, Writing proposal-solicited proposals and unsolicited proposals. — 3

Unit V Emotional Intelligence

Emotional Brain, Nature of emotional intelligence, emotional intelligence applied windows of opportunity, emotional literacy. — 4

Unit VI Interview Skills

Importance of Interview Skills, Resume Building, Group discussion and personal interview, Psychometric Test, actual career planning. — 3

General Instructions:

The students will be given six assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Suggested Text Books:

1 "Soft Skills, 2015", Career Development Centre, Green Pearl Publications.

Suggested Reference Books:

1 "Seven Habits of Highly Effective Teens", Covey Sean, New York, Fireside Publishers, 1998.
2 "How to win Friends and Influence People", Carnegie Dale, New York: Simon & Schuster,
3 "I am ok, You are ok ",Thomas A Harris, New York-Harper and Row, 1972
4 "Emotional Intelligence", Daniel Goleman, Bantam Book, 2006
5 "Effective communication skill", MTD training & Ventus publishing ApS ISBN 978-87-7681-