VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY HYDERABAD
B.TECH. II YEAR
(AUTOMOBILE ENGINEERING)

III SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT10	Partial Differential Equations and Numerical Methods	3	0	0	3	3
19PC1ME08	Mechanics of Solids	3	0	0	3	3
19PC1ME04	Thermodynamics	3	1	0	4	4
19PC1ME01	Metallurgy and Materials Engineering	3	0	0	3	3
19PC1AE01	Automotive Chassis	3	0	0	3	3
19PC2AE01	Automotive Chassis Laboratory	0	0	2	2	1
19PC2AE02	Metallurgy and Mechanics of Solids Laboratory	0	0	2	2	1
19PC2IT02	Python Programming Laboratory	0	0	2	2	1
Total		**15**	**1**	**6**	**22**	**19**

IV SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19PC1ME03	Fluid Mechanics and Machinery	3	0	0	3	3
19PC1AE02	Applied Thermodynamics	3	1	0	4	4
19PC1AE03	Theory of Machines	3	1	0	4	4
19PC1AE04	Automotive Engines	3	0	0	3	3
19PC1AE05	Manufacturing Technology	3	0	0	3	3
19PC2ME03	Fluid Mechanics and Machinery Laboratory	0	0	3	3	1.5
19PC2AE03	Theory of Machines Laboratory	0	0	3	3	1.5
19PC2AE04	Automotive Engines Laboratory	0	0	2	2	1
Total		**15**	**2**	**8**	**25**	**21**
19MN6HS02	Environmental Science	2	0	0	2	**0**

L – Lecture T – Tutorial P – Practical D – Drawing

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19BS1MT10) PARTIAL DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS
(Common to ME and AE)

COURSE PRE-REQUISITES: Differentiation, Integration

COURSE OBJECTIVES: Student will gain knowledge of
- Evaluation of Fourier coefficients
- Method of Separation of Variables to solve second order Partial Differential Equations
- Numerical methods to solve non-linear systems
- Various methods of interpolation and its application
- Concepts of numerical differentiation and integration

COURSE OUTCOMES: After completion of the course, the student will be able to
CO-1: Determine the Fourier series for periodic functions
CO-2: Solve the second order linear partial differential equations
CO-3: Apply numerical methods to find a root of algebraic and transcendental equations
CO-4: Find the interpolate value from the given set of data points
CO-5: Evaluate problems based on numerical differentiation, integration and numerical solutions of ordinary differential equations

UNIT – I:
Fourier Series: Introduction of Fourier Series, determination of Fourier coefficients, Fourier series in an arbitrary interval, Fourier series for even and odd functions, Half range sine and cosine series

UNIT – II:
Partial Differential Equations of Second Order: Classifications of Second Order Partial differential Equations, Method of separation of variables, Applications: Problems of vibrating string- wave equation, Problems of one-dimensional heat equation, Problems of steady state two dimensional heat flow-Laplace equation.

UNIT – III:
Solutions of Non-linear Systems: Introduction; Mathematical preliminaries; Solution of algebraic and transcendental equations–bisection method, the method of false position, Fixed point iterative method, Newton - Raphson method, and their order of convergence.

UNIT – IV:
Interpolation: Introduction; Errors in polynomial interpolation; Finite differences; Forward differences; Backward differences; Central differences; Symbolic relations and separation of symbols; Differences of a polynomial; Newton's formulae for interpolation; Central difference interpolation formulae; Gauss's central difference formulae and Lagrange's interpolation formulae.

UNIT – V:

Numerical Differentiation and Integration: Numerical differentiation based on interpolation, Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule, Gaussian quadrature 2 & 3-point formulae.

UNIT – VI:

Numerical Solutions of Ordinary Differential Equations: Solution of initial value problems by Taylor's series - Picard's method of successive approximations, Euler's method, Modified Euler's method and Runge - Kutta methods.

TEXT BOOKS:

1. Higher Engineering Mathematics - B. V. Ramana, McGraw-Hill Publishers
2. Advanced Engineering Mathematics - Erwin Kreyszig, 8th Edition; John Wiley
3. Introductory Methods of Numerical Analysis - S. S. Sastry, PHI learning Pvt. Ltd

REFERENCES:

1. Advanced Engineering Mathematics - Peter 'O' Neil, Cengage Learning
2. Advanced Engineering Mathematics - R. K. Jain and S. R. K. Iyengar; Narosa Publication
3. Higher Engineering Mathematics - B. S. Grewal, Khanna Publishers, 36th Edition, 2010

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME08) MECHANICS OF SOLIDS

COURSE PRE-REQUISITES: Mathematics, Physics and Engineering Mechanics

COURSE OBJECTIVES:
- To list and define the Material properties and show the relationships between them
- To describe principles of Mechanics, Stress and Strain
- To demonstrate thoroughly the concepts of principal stresses applied to solid structural members and mohr's circle diagram
- To analyse various types of mechanical engineering problems concern to bending of beams, torsion of shafts etc

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Show basic stress strain equations with appropriate assumptions
CO-2: Interpret model and analyze solid mechanics problems on bars, beams and shafts
CO-3: Apply the concepts of principal stresses in real life design issues
CO-4: Analyse and develop beams, shafts for various applications

UNIT – I:
Tension, Compression, and Shear: Introduction; Normal Stress and Strain; Stress-strain diagrams; Elasticity and plasticity; Linear elasticity and Hooke's law; Allowable stress and allowable loads.
Axially Loaded Members: Introduction; Deflections of axially loaded members; Strain energy; Dynamic loading.

Thermal Stresses

UNIT – II:
Shear Force and Bending Moment Diagrams: Types of beams; Types of loading; Shear force and bending moment; Relationship between load, shear force and bending moment; Shear force and bending moment diagrams.

UNIT – III:
Area Moment of Inertia of Composite Sections:
Stresses in Beams: Introduction; Normal strains in beams; Normal stresses in beams; Cross-sectional shapes of beams-C, angular and semicircle structures; Shear stresses in rectangular beams; Shear stress in webs of beams with flanges; Shear stress in circular beams (solid and hollow sections); Concept of shear center and shear flow.

UNIT – IV:
Analysis of Stress and Strain: Introduction; Plane stress; Principal stresses and maximum shear stresses; Mohr's circle for plane stress; Hooke's law for plane stress; Spherical and cylindrical pressure vessels (biaxial stress; Hoop and longitudinal stresses); Combined loadings (plane stress); Principal stresses in beams.

UNIT – V:

Deflections of Beams: Introduction; Differential equations of the deflection curve; Deflections by integration of the bending moment equation; Deflections by integration of the shear-force and load equations; Macaulay's method; Moment area method; Method of superposition.

UNIT – VI:

Columns: Short columns, Euler's theory for axially loaded elastic long columns, Effective length, Limitations of Euler's Theory, Rankine's formula

Torsion: Introduction; Torsion of circular bars; Non uniform torsion; Pure shear; Relationship between modulus of elasticity E and G; Transmission of power by circular shafts.

TEXT BOOKS:

1. Mechanics of Materials (SI units) by Gere, J. M., Goodno, B. J, Cengage Learning, 2012
2. Strength of Materials by S. S. Rattan, Publisher: Tata McGraw-Hill Education, 2nd Edition, 2011

REFERENCES:

1. Engineering Mechanics of Solids by Popov E.P Prentice Hall of India Private Limited, 2004
2. Mechanics of materials by Beer F.P., Johnson E.R., and DeWolf, J.T. Tata McGraw-Hill, 2004
3. Strength of Materials by Schaum's Series, Mcgraw-Hill Book Company, 6th Edition

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1ME04) THERMODYNAMICS

COURSE PRE-REQUISITES: Physics, Mathematics

COURSE OBJECTIVES:

- To apply the basic concepts of thermodynamics, heat and work done on the system
- To apply the basic concepts of Thermodynamic Laws for various thermodynamic systems
- To evaluate the properties of pure substance and to analyse the concept of irreversibility and availability
- To apply the basic concept of power cycles for External combustion engines and internal combustion engines
- To evaluate the behaviour of ideal gas mixtures and thermodynamic properties

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: To apply the basic concepts of thermodynamics, heat and work done on the system.

CO-2: To apply the basic concepts of thermodynamic laws for various thermodynamic systems

CO-3: To evaluate the properties of pure substance and to analyse the concept of irreversibility and availability

CO-4: To apply the basic concept of power cycles for external combustion engines and internal combustion engines

CO-5: To evaluate the behaviour of ideal gas mixtures and thermodynamic properties

UNIT – I:

Concepts and Definitions: Thermodynamic system and control volume; Macroscopic versus microscopic point of view; Properties and state of a substance; Processes and cycles, Energy, Specific volume and density, Equality of temperature; The Zeroth law of thermodynamics; Temperature scales.

Work and Heat: Definition of work; Units for work; Work done at the moving boundary of a simple compressible system; Other systems that involve work; Definition of heat; Heat transfer modes; Comparison of heat and work.

UNIT – II:

The First Law of Thermodynamics: The first law of thermodynamics for a control mass undergoing a cycle; The first law of thermodynamics for a change in state of a control mass; Internal energy-a thermodynamic property; Problem analysis and solution technique; Enthalpy; The constant-volume and constant-pressure specific heats; The internal energy, enthalpy, and specific heat of ideal gases; The first law as a rate equation.

First Law Analysis for a Control Volume: Conversion of mass and the control volume, the first law of thermodynamics for a control volume, The steady-state process; Examples of steady-state processes.

UNIT – III:

The Second Law of Thermodynamics: Heat engines and refrigerators; The second law of thermodynamics; The reversible process; Factors that render processes irreversible; The Carnot cycle; Two propositions regarding the efficiency of a Carnot cycle; The thermodynamic temperature scale; The ideal-gas temperature scale; Ideal versus real machines.

Entropy for a Control Mass: The inequality of Clausius; Entropy — a property of a system; The entropy of a pure substance; Entropy change in reversible processes; The thermodynamic property relation; Entropy change of an ideal gas; The reversible polytropic process for an ideal gas; Entropy change of a control mass during an irreversible process; Entropy generation; Principle of increase of entropy; Entropy as a rate equation.

UNIT – IV :

Irreversibility and Availability: Available energy; Available energy Referred to a cycle; Quality of energy; Maximum work in a reversible process; reversible work by an open system; Exchanging heat only with the surroundings; Useful work; Dead state; Availability; Availability in chemical reaction; Irreversibility and Gouy-stodola Theorem; Availability or Exergy Balance; second law efficiency;

Properties of a Pure Substance: The pure substance; Vapor- liquid- solid- phase equilibrium in a pure substance; Independent properties of a pure substance; Steam Tables; Thermodynamic surfaces; The compressibility factor; Equations of state.

UNIT – V:

Power Cycles: Introduction to power systems; The Rankine cycle; Effect of pressure and temperature on the Rankine cycle; Air-standard power cycles; Basic Brayton cycle; The air-standard cycle for jet propulsion; Reciprocating engine power cycles; The Otto cycle; The Diesel cycle; The Dual cycle, The Stirling cycle; The Atkinson and Miller cycles.

UNIT – VI:

Properties of Gases and Gas Mixtures: Avogadro's Law; Ideal Gas; Equation of State; Law of Corresponding; Properties of Mixture of Gases-Dalton's Law of Partial Pressures; Internal Energy, Enthalpy, and Specific Heats of Gas Mixtures; Entropy of Gas Mixtures; Gibbs Function of a Mixture of Inert ideal Gas; Thermodynamic Property Relations: Mathematical relations for a homogeneous phase; The Maxwell relations; Thermodynamic relations involving enthalpy, internal energy,
and entropy; The Clapeyron equation; Joule-Thompson coefficient.

TEXT BOOKS:

1. Engineering Thermodynamics by P. K. Nag, McGraw-Hill
2. Fundamentals of Thermodynamics by C. Borgnakke, R. E. Sonntag, and G. J. Van Wylen; John Wiley

REFERENCES:

1. Engineering Thermodynamics by Burgadt, Harper & Row Publication
2. Thermodynamics — An Engineering Approach by Yunus Cengel and Boles; TMH
3. Engineering Thermodynamics by P. Chattopadhyay, Oxford University Press

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME01) METALLURGY AND MATERIALS ENGINEERING
(Common to ME and AE)

COURSE PRE-REQUISITES: Physics and Chemistry

COURSE OBJECTIVES:

- To understand the microstructures of different types of metal and alloys –cast iron, steels, non-ferrous metal and alloys
- To understand the heat treatment principles-annealing, normalizing and hardening
- To understand the different types of tools
- To understand the importance of titanium & its alloys

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish different types of metals, solid solutions, alloys compounds and phases
CO-2: Design a heat treatment process to change the properties-hardness, ductility, etc
CO-3: Analyze the characters and failure of metals and alloys
CO-4: Explain & justify the usage of composites in engineering field

UNIT – I:
Metal Structure and Crystallization: Introduction - atom binding, ionic bond, covalent bond, metallic bond, and Vander Waals forces; Crystal imperfections.
Overview of Metal Structure and Crystallization.
Constitution of Alloys: Introduction; Classification of alloys or compounds; Pure metal; Intermediate alloy phase or compound - intermetallic compounds or valency compounds, interstitial compounds, and electron compounds; Solid solutions; Substitution solid solution - factors that control the range of solubility in alloy system; Interstitial solid solutions.

UNIT – II:
Phase Diagrams: Introduction; Coordinates of phase diagrams; Experimental methods - construction of equilibrium diagrams by thermal analysis, metallographic methods, and X-ray diffraction; Type-I-Two metals completely soluble in the liquid and solid states; Chemical composition of phases; relative amounts of each phase; Equilibrium cooling of a solid solution alloy; Diffusion; Nonequilibrium cooling; Homogenization; Properties of solid-solution alloys; Variation of Type I; Type II-Two metals completely soluble in the liquid state and completely insoluble in the solid state; Type III-Two metals completely soluble in the liquid state but only partly soluble in the solid state; Properties of eutectic alloy systems; Age hardening – solution treatment, and aging process; Type IV-The congruent-melting intermediate phase; Type V-The peritectic reaction; **Type VI-Two liquids partly soluble in the liquid state:** the monotectic reaction; Type VII-two metals insoluble in the liquid and solid states; Interrelation of basic types;

UNIT – III:
The Heat Treatment of Steel: Introduction; Full Annealing; Spheroidizing; Stress-relief annealing; Process annealing; Normalizing; Hardening; The isothermal transformation

diagram; Cooling curves and I-T Diagram; Transformation on continuous cooling; Position of the I-T curves, Hardening or austenitizing temperature, Mechanism of heat removal during quenching - vapor-blanket cooling state (stage A), vapor transport cooling stage (stage B), Liquid cooling stage (stage C); Quenching medium; Temperature of quenching medium, Surface condition - methods to minimize the formation of scale - copper plating, protective atmosphere, liquid-salt pots, and cast-iron chips; Size and Mass, Hardenability; Use of Hardenability data; Tempering; Austempering; Surface heat treatment or case hardening; Carburizing; Heat treatment after carburizing; Cyaniding and Carbonitriding; Nitriding; Flame hardening; Induction Hardening.

UNIT – IV:

Alloy Steels: Introduction; Purpose of alloying; Effect of alloying elements upon Ferrite; Effect of alloying elements upon carbide; Influence of alloying elements on the iron-iron carbide diagram; Effect of alloying elements in tampering; Classification of steels - nickel steel, chromium steel, nickel-chromium steels, manganese steels, molybdenum steels, tungsten steels, vanadium steels, silicon steels, stainless steels, martensitic stainless steels, ferritic stainless steels, austenitic stainless steels, precipitation-hardening stainless steels, maraging steels, and ausforming.

Tool Steels: Classification of tool steels; Selection of tool steels; Comparative properties; Non-deforming properties; Depth of hardening; Toughness; Wear resistance; Red-hardness; Machinability; Resistance to decarburization; Brand names; Water-hardening tool steels (Group W); Shock resisting tool steels (Group S); Cold-work tool steels; Hot-work tool steels (Group H); High speed tool steels; Mold Steels (Group P); Special purpose tool steels; Heat treatment of tool steels; Overview of tool failures; Special cutting materials – satellites, cemented carbides, and ceramic tools.

UNIT – V:

Cast Iron: Introduction; Types of cast iron; White cast iron; Malleable cast iron; Pearlitic malleable iron; Gray cast iron; Silicon in cast iron; Sulfur in cast iron; Manganese in cast iron; Phosphorus in cast iron; Heat treatment of grey iron, Size and distribution of graphite flakes; Mechanical properties and applications of grey cast iron; Chilled cast iron; Nodular cast iron; Alloy cast irons.

Non-Ferrous Metals and Alloys: Introduction; Copper and its alloys - Copper, temper designation of copper and copper alloys, and copper alloys; Aluminum and its alloys - Aluminum, Alloy designation system, and temper designation; Titanium and Titanium alloys.

UNIT – VI:

Composites: Introduction, classification of composites-Fibre reinforced composites, Pertial reinforced composites, Dispersion strengthened metals, laminates; Advanced Fibre reinforced composites –Metal matrix composites, Ceramic –matrix composites, Carbon - Carbon composites, Hybrid composites; Fabrication of Fibre- reinforced composites-Hand lay –up process, Filament winding process, Sheet- moulding compound process, continuous pultrusion process, resin transfer moulding, vacuum-bag moulding.

TEXT BOOKS:

1. Introduction to Physical Metallurgy by Sidney H. Avner; McGraw-Hill
2. Materials Science and Metallurgy by Kodgire, Everest

REFERENCES:

1. Essentials of Materials Science and Engineering by Donald R. Askeland and Thomson
2. Materials Science and Engineering by William and Collister
3. Elements of Materials Science by V. Raghavan
4. Metallurgy and Material Science by Pakirappa

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1AE01) AUTOMOTIVE CHASSIS

COURSE OBJECTIVES:

- To illustrate the vehicle lay-out and body types
- To provide the working of transmission systems
- To learn the basic functionality of final drive, steering and suspension systems
- To present the construction and working of brake and wheel and tyre assembly

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the vehicle lay-out and body types
CO-2: Comprehend the working of drive line systems
CO-3: Appreciate the basic functionality of final drive, steering and suspension systems
CO-4: Describe the construction and working of brake and wheel and tyre assembly

UNIT – I:
Frame and Body: Classification of automobiles, layout of chassis and sub systems and their role, types of chassis - light, medium and heavy duty vehicle chassis. Role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT – II:
Clutch and Gear Box: Types of clutch - single plate clutch, coil spring type and diaphragm spring type, multiple plate clutch, centrifugal clutch and clutch trouble diagnosis. Need for gearbox, types of gear box - sliding mesh, constant mesh and synchromesh, overdrives, transfer case, gear shifting mechanisms and transmission trouble diagnosis.

UNIT – III:
Automatic Transmission: Need for fluid coupling and torque converters, epicyclical gearbox, automatic transmission – automatic manual transmission, continuously variable transmission and fully automatic transmission, control mechanisms and limitations.

UNIT – IV:
Drive Line and Final Drive: Propeller shaft drive, torque reaction and drive thrust, Hotchkiss drive, torque tube drive and universal joints. Front axle and its types, stub axle and its types, rear axle and its types. Need for differential, working, non-slip differentials, differential lock and drive line and final drive trouble diagnosis.

UNIT – V:
Steering System: Principle of steering, Ackerman's and Davis steering mechanisms, steering layout, types of steering gearbox, types of front axle and stub axle, steering geometry. Purpose, working and types of power steering.
Suspension System: Types of suspension - rigid axle suspension and independent suspension, types of suspension spring - leaf spring, coil spring, torsion bar spring, air

spring, rubber spring and hydro elastic spring. Role and types of shock absorber, construction and working. Steering and suspension trouble diagnosis.

UNIT – VI:

Brake System: Stopping distance, time and braking efficiency, effect of weight transfer, braking torque, classification of brakes, drum and disc brakes, construction and working of mechanical, hydraulic, pneumatic, power-assisted brakes and servo brakes. Drum brake and disc brake trouble diagnosis.

Tyres and Wheels: Types and construction of wheel, tyre requirements, bias ply and radial ply tyres, tubeless tyres, wheel balancing and tyre rotation.

TEXTBOOKS:

1. Advanced Vehicle Technology, by Heinz Heisler, 2nd Edition, Butterworth Heinemann Publishers, 2002
2. Automotive Mechanics, by Giri N K, Khanna Publications, 2008

REFERENCES:

1. The Motor Vehicle, by Garrett T K, Newton K. and Steeds W., 13th Edition Butterworth Heinemann Publishers, 2001
2. Automotive Mechanics, by William Crouse and Donald Anglin, 10th Edition, McGraw- Hill Publication, 2010
3. Automotive Mechanics, by Srinivasan S, 2nd Edition, McGraw-Hill Publishing Company Ltd., 2003
4. Automotive Chassis, by Heldt P M, Chilton & Co., 1996

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PC2AE01) AUTOMOTIVE CHASSIS LABORATORY

COURSE PRE-REQUISITES: Automotive Chassis

COURSE OBJECTIVES:
- To identify and study of automotive chassis systems
- To distinguish functionality of various running and control systems
- To understand the troubles and remedies chassis systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the principle and functionality of various automotive systems
CO-2: Dismantle and assemble chassis systems
CO-3: Inspect and identify the faults chassis systems

LIST OF EXPERIMENTS
ANY **10 EXPERIMENTS** TO BE CONDUCTED FROM THE FOLLOWING

1. Dismantling, inspection and assembling of clutch
2. Dismantling, inspection and assembling of sliding mesh gear box
3. Dismantling, inspection and assembling of constant mesh gear box
4. Dismantling, inspection and assembling of synchromesh gear box
5. Dismantling, inspection and assembling of automatic gear box
6. Dismantling, inspection and assembling of transaxle
7. Dismantling, inspection and assembling of transfer case
8. Dismantling, inspection and assembling of differential unit
9. Dismantling, inspection and assembling of brake system
10. Dismantling, inspection and assembling of suspension system
11. Dismantling, inspection and assembling of steering gear box
12. Dismantling, inspection and assembling of front and rear axle

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PC2AE02) METALLURGY AND MECHANICS OF SOLIDS LABORATORY

COURSE PRE-REQUISITES: Metallurgy and Material Engineering and Mechanics of Solids

COURSE OBJECTIVES:
- To study the microstructure of different materials
- To understand the changes in microstructure after different heat treatments
- To analyze the various tests to be conducted on engineering materials
- To analyze the importance of tests in evaluating the corresponding mechanical properties

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify different materials with microstructure
CO-2: Inspect the microstructure of a given material after heat treatments
CO-3: Evaluate the result of test and comment on the mechanical properties of materials
CO-4: Decide a material and an appropriate test suitable for given application

LIST OF EXPERIMENTS
Any **10 experiments** to be conducted from the following

Metallurgy
1. Preparation and study of the microstructure of metals like Iron, Cu and Al
2. Preparation and study of the microstructure of mild steels, low carbon steels, and high carbon steels
3. Study of the microstructures of cast irons
4. Study of the microstructures of non-ferrous alloys
5. Study of the microstructures of heat treated steels
6. Hardenability of steels by Jominy end quench test
7. Study the microstructure of cutting tools
8. Study the micro structures of stainless steel

Mechanics of Solids
1. Tension test
2. Bending test - Simply supported and cantilever beams
3. Torsion test
4. Hardness test – Brinell's and Rockwell hardness tests
5. Compression test on spring
6. Compression test on a cube
7. Impact test
8. Direct shear test

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PC2IT02) PYTHON PROGRAMMING LABORATORY

COURSE OBJECTIVES:
- To Install and run the Python interpreter
- To learn control structures
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop the application specific codes using python
CO-2: Understand Strings, Lists, Tuples and Dictionaries in Python
CO-3: Verify programs using modular approach, file I/O, Python standard library
CO-4: Implement Digital Systems using Python

Exercise 1 Basics
Running instructions in Interactive interpreter and a Python Script
Write a program to purposefully raise Indentation Error and correct it

Exercise 2 Operations
Write a program to compute GCD of two numbers by taking input from the user
Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow
Write a Program for checking whether the given number is even number or not.
Write a program using for loop that loops over a sequence.
Python Program to Print the Fibonacci sequence using while loop
Python program to print all prime numbers in a given interval (use break)

Exercise – 4 Lists
Find mean, median, mode for the given set of numbers in a list.
Write a program to convert a list and tuple into arrays.
Write a program to find common values between two arrays.

Exercise – 5 Dictionary
Write a program to count the numbers of characters in the string and store them in a dictionary data structure
Write a program combine_lists into a dictionary.

Exercise – 6 Strings
Write a program to check whether a string starts with specified characters.
Write a program to check whether a string is palindrome or not

Exercise -7 Strings Continued
Python program to split and join a string
Python Program to Sort Words in Alphabetic Order

Exercise - 8 Files
Write a program to print each line of a file in reverse order.
Write a program to compute the number of characters, words and lines in a file.
Write a program to count frequency of characters in a given file.

Exercise - 9 Functions
Simple Calculator program by making use of functions
Find the factorial of a number using recursion
Write a function dups to find all duplicates in the list.
Write a function unique to find all the unique elements of a list.

Exercise - 10 Functions - Problem Solving
Write a function cumulative_ product to compute cumulative product of a list of numbers.
Write a function reverse to print the given list in the reverse order.
Write function to compute GCD, LCM of two numbers

Exercise- 11 Multi-D Lists
Write a program that defines a matrix and prints
Write a program to perform addition of two square matrices
Write a program to perform multiplication of two square matrices

Exercise - 12 - Modules
a) Install NumPypackage with pip and explore it.

Exercise - 13
Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
Write a program to implement Half Adder, Full Adder, and Parallel Adder

TEXT BOOKS:
1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly

REFERENCES:
1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W.Chun, Pearson
3. Introduction to Python, Kenneth A. Lambert, Cengage

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME03) FLUID MECHANICS AND MACHINERY
(Common to ME and AE)

COURSE OBJECTIVES:
- To understanding the properties of fluids, principles of buoyancy, flow, force and head calculations
- To evaluation of types of fluid flow, Laminar and dynamic
- To knowledge on boundary layer principles applied to airfoils
- To principles of operation of different types of hydraulic machinery
- To understanding Hydraulic systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyzing the fluid properties to solveflow, force and velocity problems
CO-2: Evaluating the flow characterizing in static and dynamic nature of flow
CO-3: Applying fluid flow and dynamics insolving problems in hydraulic machines
CO-4: Understanding the model analysis of hydraulic machinery and select appropriate machines for hydro power plant
CO-5: Analyzing the hydraulic systems

UNIT – I:
Fluid Statics: Properties of fluid – specific gravity, viscosity, surface tension, vapor pressure and their influence on fluid motion, Pressure at a point, measurement of pressure, Forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floating and submerged bodies.

UNIT – II:
Fluid Kinematics: Introduction, methods of describing the fluid motion, Classification of flows, acceleration equations, Stream line, path line and streak lines and stream tube, continuity equation, Stream function, velocity potential function, introduction to free and forced vortex flows.

UNIT – III:
Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equation, Venturimeter, Orifice meter, Pitot tube, Reynolds experiment –Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel. Momentum equation, force on pipe bends.

UNIT – IV:
Boundary Layer Theory: Development of boundary layer along a thin flat plate, laminar boundary layer and turbulent boundary layer, Laminar sub layer, boundary layer separation, Drag and lift forces - Aero foils, pressure and form drags.
Impact of Jets: Hydrodynamic force of jets on flat, inclined and curved vanes - jet striking centrally and at tip, flow over radial vanes.

UNIT – V:

Hydraulic Turbines: Classification of turbines, design of Pelton wheel, Francis turbine and Kaplan turbine – working proportion, work done, efficiency, draft tube- theory, functions and efficiency. Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank and water hammer, elements of hydropower plant.

UNIT – VI:

Hydraulic Pumps: Classification, centrifugal pumps – types, working, work done, monomeric head, losses and efficiency, specific speed – pumps in series and parallel – performance characteristic curves, NPSH, Reciprocating Pump – types, Working, Discharge, slip, indicator diagrams

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics Including Hydraulics Machines: P. N. Modi, S. M. Seth
2. Introduction to Fluid Mechanics: R. W. Fox, A. T. McDonald and P. J. Pritchard

REFERENCES:

1. Fluid Mechanics: V. L. Streeter & E. B. Wylie
2. Fluid Mechanics, Fundamentals & Applications: Yunus A. Çengel, John M. Cimbala
3. Fluid Mechanics: F. M. White
4. Fundamentals of Fluid Mechanics: Bruce Roy Munson, Donald F. Young, Theodore H. Okiishi, Wade W. Huebsch, Wiley Publication

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1AE02) APPLIED THERMODYNAMICS

COURSE PRE-REQUISITES: Mathematics and Thermodynamics

COURSE OBJECTIVES:
- To extend thermodynamic principles to different thermodynamic systems
- To understand the energy conversion processes and equipment
- To provide basic concepts of refrigeration and psychrometry

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply thermodynamic principles to understand various thermodynamic systems
CO-2: Investigate the effectiveness of energy conversion processes/components in mechanical power generation
CO-3: Analyse the vapour compression refrigeration cycle and carry out basic psychrometric calculations

UNIT – I:
Steam Generators: Introduction, classification of boilers, working principles of fire tube and water tube boilers, low pressure boilers, high pressure boilers, Babcock and Wilcox, Lamont boiler, boiler draught, performance of boilers and equivalent evaporation.

UNIT – II:
Steam Condensers: Introduction, purpose and types of condenser, efficiency of condenser and Edward air pump.
Steam Nozzles: Functions of nozzle, applications, types, flow through nozzles, thermodynamic analysis, assumptions, velocity of nozzle at exit, ideal and actual expansion in nozzle, velocity co-efficient, condition for maximum discharge and critical pressure ratio.

UNIT – III:
Impulse Turbine: Mechanical details, velocity diagram, effect of friction, power developed, axial thrust, diagram efficiency, condition for maximum efficiency and methods to reduce rotor speed.
Reaction Turbine: Mechanical details, principle of operation, Thermodynamic analysis of a stage, Degree of reaction, velocity diagram, parson's reaction turbine and condition for maximum efficiency.

UNIT – IV:
Reciprocating Compressors: Principle of operation, work required, isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, under cooling, saving of work and minimum work condition for stage compression.
Rotary Compressors: Classification, roots blower, vane blower, centrifugal compressor and axial compressor (Qualitative treatment only).

UNIT – V:

Gas Turbines: Classification of gas turbine plants, ideal cycle, essential components, parameters of performance, actual cycle, regeneration, inter cooling and reheating.
Jet and Rocket Propulsions: Classification of Jet propulsion, turbo jet and turboprop. Solid and liquid propellant rockets.

UNIT – VI:

Refrigeration: Ideal refrigeration cycles - Vapor compression refrigeration cycle, Bell Coleman refrigeration cycle and vapour absorption refrigeration system
Psychrometry: Psychrometric properties, psychrometric chart and psychrometric processes – Sensible heating and cooling, humidification and dehumidification, humidification with heating/cooling and dehumidification with heating/cooling.

TEXT BOOKS:

1. Thermal Engineering, by Mahesh M Rathore, McGraw Hill Education (India) Pvt. Ltd., 2016
2. Gas Turbines, by Ganesan V, TMH Publications, 2010

REFERENCES:

1. Thermal Engineering, by Rajput R K, Laxmi Publications, 2010
2. Thermodynamics and Heat Engines, by Yadav R, Central Book Depot, 2002
3. Thermal Engineering, by Ballaney P L, Khanna Publishers, 2010
4. Gas Turbines and Propulsive systems, by Khajuria P and Dubey S P, Dhanpat Rai & Sons, 2012

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1AE03) THEORY OF MACHINES

COURSE PRE-REQUISITES: Engineering Mathematics, Engineering Mechanics and Engineering Graphics

COURSE OBJECTIVES:
- To know different machine elements and mechanisms
- To understand kinematic and dynamic characteristics of different mechanisms
- To select suitable drives and mechanisms for a particular application
- To discuss the concepts of governors and gyroscope

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify mechanisms and predict their motion
CO-2: Analyse kinematic and dynamic characteristics of different mechanisms
CO-3: Apply suitable drives and mechanisms
CO-4: Evaluate performance of governors and effects of gyroscopic couple

UNIT – I:
Mechanisms and Machines: Introduction, mechanism and machine, rigid and resistant bodies, link, kinematic pair, degrees of freedom, classification of kinematic pairs, kinematic chain linkage, mechanism and structure and mobility of mechanisms. The four-bar chain, the slider-crank chain and double slider-crank chain mechanisms, inversions of these mechanisms and mechanical advantage.

UNIT – II:
Kinematics: Velocity and acceleration-motion of link in machine - Determination of velocity and acceleration diagrams, relative velocity method, application of relative velocity method-four bar chain and single slider crank chain, Klein's construction, Coriolis acceleration, determination of Coriolis component of acceleration
Plane Motion of Body: Instantaneous center of rotation, centrode - relative motion between two bodies-Three centers in line theorem.

UNIT – III:
Cams: Definition of cam and followers-their uses-types of followers and cams-terminology-types of follower motion-uniform velocity-simple harmonic motion and uniform acceleration, maximum velocity and acceleration during outward and return strokes in the above three cases.

UNIT – IV:
GEARS: Friction wheels and toothed gears-types-law of gearing, condition for constant velocity ratio for transmission of motion, forms of teeth - Cycloidal and involute profiles. Velocity of sliding - Phenomena of interference, condition for minimum number of teeth to avoid interference, expression for arc of contact and path of contact.
Gear Trains: Introduction, train value, types - Simple and reverted gear trains, epicyclic gear train, methods of finding train value or velocity ratio and differential gear for an automobile.

UNIT – V:

Governors: Necessity of governor, Classification of Governors, Working principle of centrifugal governors- Watt, porter, Proell and Hartnell governors Stability of governor, Condition for stability, Concept of isochronism, Sensitivity of governor, Characteristics of governors, hunting of governors.

UNIT – VI:

Gyroscope: Angular velocity, angular acceleration, gyroscopic torque, gyroscopic effect on naval ships, stability of an automobile and stability of a two-wheel vehicle.

TEXT BOOKS:

1. "Theory of Machines", by Ratan S.S, 4th Edition, Tata McGraw Hill, 2017
2. "Theory of machines", by Gordon R. Pennock & Joseph E. Shigley John J. Uicker, 4th Edition, Oxford University Press, 2014

REFERENCES:

1. "Theory of Machines", by Thomas Bevan, 3rd Edition, Pearson Education, 2009
2. "Theory of machines", by Khurmi R. S & Gupta J. K, S.Chand Publishing, 1976
3. "Design of Machinery", by RobartL.Norton, 3rd Eedition, Tata McGraw Hill,2004
4. "Theory of machines", by Sadhu Singh, 3rd Edition, Pearson education, 2011
5. "Theory of Machines", by Ballaney, P. L, Khanna Publishers, 2003

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1AE04) AUTOMOTIVE ENGINES

COURSE PRE-REQUISITES: Physics and chemistry

COURSE OBJECTIVES:
- To present the constructional details and combustion in automotive engines
- To learn the principle and functions of an automotive engine sub-systems
- To know engine measurements and performance characteristics
- To provide the concepts and working of unconventional engines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the constructional details and combustion in automotive engines
CO-2: Describe the principle and functions of an automotive engine sub-systems
CO-3: Analyze engine measurements and performance characteristics
CO-4: Discuss the concepts and working of unconventional engines

UNIT – I:
Engine: Classification, principle, construction and working of four stoke and two stroke SI and CI engines. Theoretical and actual indicator, valve and port timing diagrams, stages of combustion in SI and CI engines, abnormal combustion and combustion chambers.

UNIT – II:
Fuel System: Air fuel ratio requirements, principle and working of carburetor, multi-point fuel injection and gasoline direct injection. Diesel fuel injection pump, types of nozzles and common rail direct injection.

UNIT – III:
Engine Sensors and Actuators: Role of engine management system, sensors – engine speed, mass air flow, manifold absolute pressure, throttle position, knock, temperature, exhaust oxygen level and accelerometers, actuators - solenoids, relays, piezoelectric force generators and stepper motors and engine mapping.

UNIT – IV:
Cooling and Lubrication: Necessity of cooling, air-cooling, water cooling - thermosyphon and pump cooling, radiator, pump, thermostat, antifreeze solution and radiator fan. Mist, splash and forced lubrication, oil filters and oil pumps.

UNIT – V:
Engine Performance and Supercharging: Engine power, measurement of friction power, engine efficiencies, performance characteristics and heat balance.
Supercharging - mechanical supercharging, turbocharging, types of superchargers and methods of supercharging.

UNIT – VI:
Unconventional Engines: Stiriling engine - Working Principle, two piston engine, control system, fuel requirement, emissions, merits and demerits. Wankel engine - Construction

and working, performance, emissions, merits and demerits. Variable compression ratio engine - Necessity, theoretical analysis, different methods. HCCI engine – principle and Strategies for Mixture Preparation, and stratified charge engine – methods of charge stratification.

TEXT BOOKS:

1. "Internal Combustion Engine Fundamentals", by John B Heywood, 2nd Edition, McGraw-Hill Education, 2018
2. "Internal Combustion Engines", by Mathur ML and Sharma RP, Dhanpat Rai Publications, New Delhi, 2014

REFERENCES:

1. "Internal Combustion Engines", by Ganesan V, 4th Edition, Tata McGraw Hill, New Delhi, 2017
2. Advanced Vehicle Technology, by Heinz Heisler, Butterworth Heinemann Publishers, 2002
3. Introduction to Internal Combustion Engines, by Richard Stone, SAE Publications,1999
4. Internal Combustion Engine, by Willard W Pulkrabek, Prentice Hall Publication, 1997

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1AE05) MANUFACTURING TECHNOLOGY

COURSE PRE-REQUISITES: Metallurgy and Material Science and Workshop /Manufacturing Practices

COURSE OBJECTIVES:

- To understand about sand casting and metal casting techniques
- To impart the knowledge of various welding processes
- To understand about the importance of mechanical working processes
- To appreciate metal cutting process and working principles of various machine tools

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select the suitable casting technique for making the components
CO-2: Perform different welding processes and understand importance of welding
CO-3: Know the various metal working processes
CO-4: Analyze the metal cutting process and perform various machining processes

UNIT – I:
Casting: Steps involved in making a casting; Advantage of casting and its applications; Types of foundry sands, Types of patterns – Materials used for patterns, Pattern allowances; Principles of Gating, Gating ratio; Risers- Types;
Special casting processes: Centrifugal, Die, Investment casting only, Cupola furnace and Electric arc furnace only.

UNIT – II:
Welding: Classification of welding processes, types of welded joints, Gas welding, TIG & MIG welding, Resistance welding, thermit welding, friction stir welding, Soldering and Brazing, Welding defects.

UNIT – III:
Mechanical Working-I: Hot working; Cold working; Strain hardening; Recovery; Recrystallisation and grain growth; Blanking and piercing; Bending and forming; Drawing and its types; Wire drawing and Tube drawing; Coining; Hot and cold spinning. {Limited to processes, advantages, disadvantages and applications only}

UNIT – IV:
Mechanical Working-II: Extrusion - Basic extrusion process and its characteristics; Hot extrusion and Cold extrusion; Forward extrusion and Backward extrusion – Impact extrusion; Hydrostatic extrusion; Extrusion defects. Forging Processes - Principles of forging; Tools and dies; Types of Forging; Smith forging; Drop Forging; Forging defects. {Limited to processes, advantages, disadvantages and applications only}

UNIT – V:
Theory of Metal Cutting: Elements of cutting process, classification of cutting tools, geometry of single point tool, orthogonal cutting, chip formation and types of chips.

Force relationships (Merchant's force circle), velocity relationships, cutting speed, feed, depth of cut. Tool wear and tool life, coolants, machinability and tool materials. Engine Lathe: Principle of working, Classification, Specifications, Lathe parts, Work holders, Tool holders, Lathe attachments, Operations performed and Machining time.

UNIT – VI:

Milling Machine: Principle of working, Classification, Specifications, Features of horizontal, vertical and universal milling machines, Milling cutters, Operations performed, Overview on indexing and Machining time.

Shaping, Slotting and Planning Machines: Principle of working, parts, Specifications, Classification, Operations performed.

Drilling and Boring Machines: Principle of working, Parts, Specifications, Classification and Operations performed.

Overview on Grinding Process and Machines

TEXT BOOKS:

1. Manufacturing Technology Volume - I & II, by Rao P.N, 5th Edition, McGraw-Hill, 2018
2. Production Technology, by Jain R.K, Khanna Publishers, 2004

REFERENCES:

1. Manufacturing Engineering and Technology, by Kalpakjian S, Schmid R, 4th Edition, Pearson Publishers, 2002
2. Production Technology, by Sharma P C, 8th Edition, S. Chand publishing, 2014
3. Principles of Modern Manufacturing, by Mikell P. Groover, 5th Edition, Wiley,2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2ME03) FLUID MECHANICS AND MACHINERY LABORATORY (Common to ME and AE)

COURSE PRE-REQUISITES: Fluid Mechanics and Hydraulic Machines

COURSE OBJECTIVES:

- To analyzing the experiments to understand the concept, find the values and obtain the result of experiments
- To apply fundamental principles of fluid mechanics for the solution of practical mechanical engineering problems of water conveyance in pipes, orifices, mouth pieces, notches & weirs
- To analyzing various pumps, water turbines, pipes and pressure measurement devices
- To evaluating efficiency for pumps and turbines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply fundamental equations of fluid mechanics for turbines and pumps
CO-2: Model and analyse fluid flow problems in mechanical engineering
CO-3: Create a model of fluid flow equipments
CO-4: Evaluate the experimental results with theoretical concepts

LIST OF EXPERIMENTS:

ANY 10 EXPERIMENTS to be conducted from the following:

1. Verification of Bernoulli's theorem
2. Calibration of Venturimeter/ Orifice meter.
3. Calibration of notches.
4. Determination of friction factor for a given pipe.
5. Determination of Minor losses for the given equipment
6. Impact of jet on vanes.
7. Performance test on Pelton wheel.
8. Performance test on Francis turbine.
9. Performance test on Kaplan turbine.
10. Performance test on single stage centrifugal pump.
11. Performance test on multi stage centrifugal pump.
12. Performance test on reciprocating pump.

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2AE03) THEORY OF MACHINES LABORATORY

COURSE PRE-REQUISITES: Theory of Machines

COURSE OBJECTIVES:

- To evaluate the follower movement and mass moment of Inertia
- To Understand the working of various governors
- To study the static and dynamic balancing and gyroscopic effects
- To analyze whirling of shaft and natural frequency of undamped and damped free vibration system

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Balance the static and dynamic forces and identify the effects of gyroscopic couple

CO-2: Calculate the natural frequency of Undamped and damped free vibration system

CO-3: Draw cam profile based on the follower movement and calculate the mass moment of inertia

CO-4: Analyse the various governors

LIST OF EXPERIMENTS

Any **10 experiments** to be conducted from the following

1. Pressure distribution in journal bearing
2. Follower and cam analysis
3. Hartnell governor test
4. Porter and Proell governor test
5. Static and dynamic balancing using rigid blocks
6. Motorized gyroscope
7. Bifilar and Trifilar suspension system test
8. Whirling speed of a given shaft
9. Undamped torsional vibration of a single rotor shaft and two rotor shaft system
10. Damped force vibration of a spring mass system
11. Undamped free vibration of an equivalent spring mass system
12. Coriolli's component of acceleration at various speeds of rotation
13. Study of epicyclic gear train

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PC2AE04) AUTOMOTIVE ENGINES LABORATORY

COURSE PRE-REQUISITES: Automotive engines

COURSE OBJECTIVES:
- To show valve and port timing diagrams
- To test performance characteristics of IC engine and compressor
- To estimate optimum cooling and heat balancing of an engine
- To perform dismantling and assembling of an engine

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Illustrate valve and port timing diagrams
CO-2: Analyze performance characteristics of IC engine and compressor
CO-3: Evaluate optimum cooling and heat balancing of an engine
CO-4: Demonstrate dismantling and assembling of an engine

LIST OF EXPERIMENTS
Any **10 experiments** to be conducted from the following

1. Valve timing diagram for 4-stroke Diesel engine
2. Valve timing diagram for 4-stroke petrol engine
3. Port timing diagram for 2-stroke petrol engine
4. Performance test on 4-stroke single cylinder Diesel engine
5. Performance test on 4-stroke single cylinder petrol engine
6. Heat balance test on 4-stroke single cylinder Diesel engine
7. Morse test on multi-cylinder petrol engine
8. Optimum cooling temperature test on single cylinder Diesel engine
9. Performance evaluation on computerized Diesel engine
10. Performance test on reciprocating compressor test rig
11. Dismantling, inspection and assembling of multi-cylinder petrol engine
12. Dismantling inspection and assembling of multi-cylinder Diesel engine

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**2**	**0**

(19MN6HS02) ENVIRONMENTAL SCIENCE

COURSE PRE-REQUISITES: Basic knowledge of environmental issues

COURSE DESCRIPTION:
Environmental science is the study of patterns and processes in the natural world and their modification by human activity. We as human beings are not an entity, separate from the environment around us, rather we are a constituent seamlessly integrated and co-exist with the environment around us. To understand current environmental problems, we need to consider physical, biological and chemical processes that are often the basis of those problems. The course requires the students to identify and analyse natural and human- made environmental problems, evaluate the relative risks associated with these problems, and examine alternative solutions for resolving or preventing them. This course will survey some of the many environmental science topics at an introductory level, ultimately considering the sustainability of human activities on the planet. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa

COURSE OBJECTIVES:
- To recognize the impacts of human interventions towards environment
- To list out the benefits in creating a sustainable environment
- To sketch out various activities in achieving a cleaner environment
- To emphasize the role of an individual for a better planet to live

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain a variety of experiences & acquire a basic knowledge about the environment & its allied problems
CO-2: Interpret the key components in safe guarding the environment
CO-3: Appraise the quality of environment in order to create a healthy atmosphere
CO-4: Familiarize with the individual responsibilities towards green revolution

MODULE 1: INTRODUCTION
Environmental Science: Introduction, Definition, scope and importance.

MODULE 2: AWARENESS ACTIVITIES
Small group meetings about:
- Water management
- Projects Vs Environment
- Generation of less waste
- Promotion of recycle use
- Impact of Science & Technology on Environment
- Avoiding electronic waste

MODULE 3: SLOGAN AND POSTER MAKING EVENT
- Food waste management
- Rain water harvesting

- Climate change
- Green Power
- Water conservation
- Green at work
- Role of IT in environment and human health
- Sustainable development

MODULE 4: EXPERT LECTURES ON ENVIRONMENTAL SCIENCE
- Environmental Impact Assessment
- Industrial waste treatment
- Organic farming/Vertical gardens/Hydroponics

MODULE 5: CLEANLINESS DRIVE
- Indoor air pollution
- Vehicular pollution
- VISUAL pollution
- Waste management at home
- Composting
- Plastic recycling

MODULE 6: CASE STUDIES
- HPCL disaster in Vizag
- Oleum gas leak in Delhi
- Mathura Refinery & Taj Mahal
- Conservation of Hussain Sagar lake
- The Cleanliest city of India-Surat
- Green Buildings in India
- KBR park in Hyderabad (Environmental protection Vs Development)
- Fluorosis
- Ecotourism & its impacts

TEXT BOOKS:
1. Environmental Studies for UG Courses, Erach Bharucha, UGC Publications, Delhi, 2004
2. Textbook of Environmental Studies, Deeksha Dave, S. S. Katewa, Cengage Delmar Learning India Pvt., 2012

REFERENCES:
1. Introduction to Environmental Science, Y. Anjaneyulu, BS Publications, 2004
2. Environmental Studies by Anubha Kaushik & C. P. Kaushik, 4th Edition, New Age International Publishers