VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. II YEAR
AUTOMOBILE ENGINEERING

III SEMESTER **R22**

Course Code	Title of the Course	L	T	P/D	CH	C
22BS1MT203	Partial Differential Equations and Probability and Statistics	2	1	0	3	3
22PC1AE202	Automotive Chassis	3	0	0	3	3
22PC1AE203	Engineering Metallurgy and Materials	3	0	0	3	3
22PC1AE204	Mechanics of Materials	3	0	0	3	3
22PC1AE205	Fundamentals of Thermodynamics	3	1	0	4	4
22PC2AE213	Metallurgy and Mechanics of Materials Laboratory	0	0	2	2	1
22PC2AE202	Automotive Chassis Laboratory	0	0	2	2	1
22SD5DS203	Python Programming and Practice	0	0	2	2	1
22SD5AE202	Field Project	0	0	2	2	1
22MN6HS103	Happiness and Wellbeing	2	0	0	2	0
Total		**16**	**2**	**8**	**26**	**20**

IV SEMESTER **R22**

Course Code	Title of the Course	L	T	P/D	CH	C
22HS1MG201	Engineering Economics and Accountancy	3	0	0	3	3
22PC1AE206	Automotive Engines	3	0	0	3	3
22PC1AE207	Theory of Machines and Mechanisms	3	0	0	3	3
22PC1AE208	Fluid Mechanics and Heat Transfer	3	0	0	3	3
22PC1AE209	Applied Thermodynamics	3	0	0	3	3
22PC2AE206	Automotive Engines Laboratory	0	0	2	2	1
22PC2AE207	Theory of Machines and Mechanisms Laboratory	0	0	2	2	1
22PC2AE208	Fluid Mechanics and Heat Transfer Laboratory	0	0	2	2	1
22PW4AE201	Design Thinking	1	0	2	3	2
22MN6HS201	Intellectual Property Rights	2	0	0	2	0
Total		**18**	**0**	**8**	**26**	**20**

L – Lecture T – Tutorial P – Practical D – Drawing CH – Contact Hours/Week
C – Credits SE – Sessional Examination CA – Class Assessment ELA – Experiential Learning Assessment
SEE – Semester End Examination D-D – Day to Day Evaluation LR – Lab Record
CP – Course Project PE – Practical Examination

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22BS1MT203) PARTIAL DIFFERENTIAL EQUATIONS, PROBABILITY AND STATISTICS

TEACHING SCHEME		
L	T/P	C
2	1	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Ordinary Differential Calculus and Vector Calculus

COURSE OBJECTIVES:
- To learn methods of solving first order partial differential equations
- To learn method of separation of variables to solve second order partial differential equations
- To learn probability distribution functions and methods of calculating correlation coefficient
- To understand the concept of sampling distribution
- To learn the various methods to test the hypothesis for large and small samples

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Solve the first order linear partial differential equations
CO-2: Solve the second order linear partial differential equations
CO-3: Solve problems involving probability distributions and calculate coefficient of correlation
CO-4: Evaluate sampling distribution of means and variance
CO-5: Apply the knowledge to test the hypothesis for large and small samples

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	3	1	-	-	-	-	-	-	-	-	3	2
CO-2	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO-3	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO-4	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO-5	3	2	1	-	-	-	-	-	-	-	-	-	1	-

UNIT – I:
Partial Differential Equations of First Order: Introduction and formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, Solutions of first order linear (Lagrange's) equation and non-linear (standard type) first order equations, Charpit's method.

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.

UNIT – III:

Probability Distributions and Correlation: Basic probability, Random variables - discrete and continuous distributions - Expectation of Random Variables. Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions –related properties, Correlation - Coefficient of correlation, rank correlation

UNIT – IV:

Sampling Distributions: Definition of population, sampling, statistic, parameter, Types of sampling, sample mean and Variance, sampling distribution, standard error, sampling distributions of means and variance, Estimation, interval estimation, point estimation and confidence interval for the mean.

UNIT – V:

Testing of Hypothesis for Large and Small Samples: Central limit theorem, Tests of hypothesis - null hypothesis, alternate hypothesis, type I, type II errors, critical region. Large samples- test of hypothesis for single mean and difference between the means. Test of significance-t distribution, confidence interval for the t- distribution, F-distribution and Chi square distribution.

TEXT BOOKS:

1. Higher Engineering Mathematics, B. V. Ramana, McGraw-Hill
2. Advanced Engineering Mathematics, Erwin Kreyszig, 8th Edition, John Wiley
3. Probability and Statistics for Engineers, Richard A. Johanson, 5th Edition, Prentice-Hall, 1995

REFERENCES:

1. Higher Engineering Mathematics, B. S. Grewal, 35th Edition, Khanna Publishers, 2000
2. Advanced Engineering Mathematics, R. K. Jain & Iyengar, Narosa Publications
3. Fundamentals of Mathematical Statistics, S. C. Gupta & V. K. Kapoor, S. Chand

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22PC1AE202) AUTOMOTIVE CHASSIS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

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 and final drive systems
CO-3: Appreciate the basic construction and functionality of steering, suspension, brake and wheel, tyre assembly systems

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	2	-	-	-	2	1	-	-	-	-	1	3	3
CO-2	2	2	-	-	-	2	1	-	-	-	-	1	3	3
CO-3	2	2	-	-	-	2	1	-	-	-	-	1	3	3

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

UNIT-II:
Clutch: Types of clutches - single plate clutch, coil spring type and diaphragm spring type, multiple plate clutch, centrifugal clutch, and clutch trouble diagnosis.
Gear Box: 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.

Drive Line and Final Drive: Propeller shaft drive, 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 final drive trouble diagnosis.

UNIT-IV:

Steering System: Principle of steering, Ackerman's and Davis steering mechanisms, steering layout, types of steering gearbox, steering geometry. Purpose, working and types of power steering and Steering trouble diagnosis

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. Pneumatic suspension system and trouble diagnosis.

UNIT-V:

Brake System: Stopping distance, time and braking efficiency, classification of brakes, drum and disc brakes, construction and working of mechanical, hydraulic, pneumatic, power-assisted brakes and servo brakes. Purpose and layout of Anti-lock braking system. Drum brake and disc brake trouble diagnosis.

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

TEXT BOOKS:

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

REFERENCES:

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

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/107/106/107106088/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22PC1AE203) ENGINEERING METALLURGY AND MATERIALS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Physics and Chemistry

COURSE OBJECTIVES:
- To understand crystal structure, crystal defects and solid solutions
- To study different types of binary phase diagrams
- To provide the microstructures, properties and applications of engineering materials
- To understand heat treatment principles

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify the defects and relate their effect on material properties
CO-2: Differentiate various types of binary phase diagrams
CO-3: Select the materials based on engineering applications
CO-4: Design a heat treatment process to get desired properties

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	-	-	2	2	-	-	1	-	2	2	1
CO-2	3	2	2	-	-	2	2	-	-	1	-	2	2	1
CO-3	3	2	2	-	-	2	2	-	-	1	-	2	2	1
CO-4	3	2	2	-	-	2	2	-	-	1	-	2	2	1

UNIT-I:
Metal Structure and Crystallization: Introduction - atom binding, ionic bond, covalent bond, metallic bond, and Vander Waals forces, crystal imperfections- point defect, line defect, surface defect and volume defect. crystal systems, crystal planes and directions, atomic packing efficiency, solid solutions, substitution solid solution - factors that control the range of solubility in alloy system and interstitial solid solutions.

UNIT-II:
Phase Diagram: Gibbs's Phase rule, Interpretation of mass fractions using Lever's rule - Hume Rothery rules-Binary Iso-morphous system, binary eutectic alloy system (Lead-Tin system), binary peritectic alloy system (Iron-nickel system), invariant reactions, Iron-Iron carbide phase diagram, slow cooling of Hypo and hyper eutectoid steels, temperature-time-transformation (TTT) and continuous cooling transformation (CCT) diagrams, different heat treatment techniques, annealing, tempering, hardening,

thermo-mechanical treatment, fundamentals of surface hardening treatment, carburizing, carbonitriding and nitriding.

UNIT-III:

Steels:

Alloy Steels: Introduction, purpose of alloying, classification of steels, stainless steels, martensitic stainless steels, ferritic stainless steels, austenitic stainless steels, precipitation-hardening stainless steels, maraging steels, and ausforming.

Tool Steels: Selection of tool steels, classification of tool steels, 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, heat treatment of tool steels, special cutting materials – satellites, cemented carbides and ceramic tools.

UNIT-IV:

Cast Iron: Introduction, Types of cast iron, white cast iron, malleable cast iron, gray cast iron, heat treatment of grey iron, size and distribution of graphite flakes, mechanical properties and applications of grey cast iron, chilled cast iron and nodular cast iron.

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-V:

Composites: Introduction, classification of composites-fiber reinforced composites, dispersion strengthened metals, laminates, advanced fiber reinforced composites – metal matrix composites, ceramic –matrix composites, carbon - carbon composites, hybrid composites, fabrication of fiber- reinforced composites-hand lay –up process, filament winding process, continuous pultrusion process, resin transfer molding and vacuum bag molding.

TEXT BOOKS:

1. Introduction to Physical Metallurgy, Sidney H. Avner, 2nd Edition, McGraw-Hill, 2017
2. Materials Science and Engineering: A First Course, V. Raghavan, 6th Edition, PHI Learning, 2015
3. Materials Science and Metallurgy, Kodgire, 31st Edition, Everest Publishing House, 2011

REFERENCES:

1. Essentials of Materials Science and Engineering, Donald R. Askeland and Pradeep P Fulay, 2nd Edition, Cengage India, 2013
2. Materials Science and Engineering: An Introduction, William and Collister, 9th Edition, Wiley Publishers, 2013

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/113/102/113102080/
2. https://www.vssut.ac.in/lecture_notes/lecture1424355321.pdf

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22PC1AE204) MECHANICS OF MATERIALS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

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, buckling of columns and torsion of shafts

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

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	2	-	-	2	-	-	-	-	1	2	3
CO-2	3	3	2	2	-	-	2	-	-	-	-	1	3	3
CO-3	3	3	2	2	-	-	2	-	-	-	-	1	3	3

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 and dynamic loading.
Thermal Stresses: Compound sections

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.
Torsion: Introduction, torsion of circular bars, non uniform torsion, pure shear, relationship between modulus of elasticity E and G and transmission of power by circular shafts.

UNIT – III:

Stresses in Beams: Introduction to area moment of inertia of composite sections like I, C and T, normal strains in beams, normal stresses in beams, shear stresses in rectangular beams, shear stress in webs of beams with flanges and shear stress in circular beams (solid and hollow sections)

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) and 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 and method of superposition.

Columns: Short columns, Euler's theory for axially loaded elastic long columns, effective length, limitations of Euler's theory and Rankine's formula.

TEXT BOOKS:

1. Mechanics of Materials (SI units), Gere J. M., Goodno B. J., Cengage Learning, 2012
2. Strength of Materials, S. S. Rattan, 3rd Edition, McGraw-Hill, 2017

REFERENCES:

1. Engineering Mechanics of Solids, Popov E. P., Prentice Hall of India, 2004
2. Mechanics of Materials, Beer F. P., Johnson E. R., and DeWolf J. T., McGraw-Hill, 2004
3. Strength of Materials, Schaum's Series, 6th Edition, McGraw-Hill, 2013

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/102/112102284/
2. https://nptel.ac.in/courses/105/105/105105108/
3. https://nptel.ac.in/courses/105/106/105106172/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22PC1AE205) FUNDAMENTALS OF THERMODYNAMICS

TEACHING SCHEME		
L	T/P	C
3	1	4

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Physics, General Mathematics

COURSE OBJECTIVES:
- To understand the basic concepts of thermodynamics and thermodynamic laws to thermal systems
- To learn the use of steam tables and Mollier diagram for pure substances and also study the concept of gas mixtures
- To apply thermodynamic laws on power cycles and concept of availability

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To explain fundamental thermodynamic properties and solve problems using the properties and relationships of thermodynamic fluids
CO-2: To apply thermodynamic laws to various systems
CO-3: To analyse basic thermodynamic cycles

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	1	-	-	1	-	-	1	-	2	2	1
CO-2	3	3	1	2	1	-	1	-	-	1	-	2	2	1
CO-3	3	3	1	2	1	2	2	-	1	1	-	2	2	1

UNIT – I:
Introduction: Macroscopic versus microscopic point of view, thermodynamic system and control volume, thermodynamic properties, processes and cycles, thermodynamic equilibrium, quasi-static process, the zeroth law of thermodynamics, measurement of temperature using thermocouple and electrical resistance thermometer.
Work and Heat Transfer: Displacement work, path function and point function, pdV work in various quasi-static processes, free expansion with zero work transfer, heat transfer - a path function, specific and latent heat and Comparison of heat and work.

UNIT – II:
First Law of Thermodynamics: First law for a closed system undergoing a cycle, first law for a closed system undergoing a change of state, energy-a property of system, different forms of stored energy, specific heat at constant volume, enthalpy, specific heat at constant pressure and perpetual motion machine of the first kind-PMM1

First Law Applied to Flow Processes: Steady flow process, mass balance and energy balance in a simple steady flow process, examples of steady-state processes-Nozzle and diffuser, throttling device, turbine and compressor.

UNIT – III:

Second Law of Thermodynamics: Heat engines and refrigerators, the second law of thermodynamics, equivalence of Kelvin-Plank and Clausius statements, the reversible process, causes of irreversibility, The Carnot cycle, Reversed heat engine, Carnot's theorem, corollary of Carnot's theorem, absolute thermodynamic temperature scale and the ideal-gas temperature scale.

Entropy for a Control Mass: Clausius theorem, entropy-a property of a system, temperature -entropy plot, the inequality of Clausius, entropy change in irreversible process, entropy principle, transfer of heat through finite temperature difference and mixing of two fluids.

UNIT – IV:

Properties of a Pure Substance: P-V diagram for a pure substance, P-T diagram for a pure substance, T-S diagram for a pure substance, Mollier diagram for a pure substance, dryness fraction, steam tables, saturated state and measurement of steam quality.

Properties of Gases and Gas Mixtures: Avogadro's Law, ideal gas, equation of state, properties of mixture of gases-Dalton's law of partial pressures, internal energy, enthalpy, and specific heats of gas mixtures, entropy of gas mixtures, the Maxwell relations, Tds equations, the Clapeyron equation and Joule-Thompson coefficient.

UNIT – V:

Irreversibility and Availability: Available energy, available energy referred to a cycle, decrease in available energy when heat is transferred through a finite temperature difference, dead state, availability in steady flow process, availability in non-flow process and second law efficiency.

Power Cycles: Rankine cycle, simple Brayton cycle, Otto cycle, Diesel cycle, Dual cycle and Atkinson cycle.

TEXTBOOK:

1. Engineering Thermodynamics, P. K. Nag, 6th Edition, McGraw-Hill, 2017

REFERENCES:

1. Fundamentals of Thermodynamics, Claus Borgnakke and Richars E. Sonntag, 7th Edition, Wiley Publishers, 2009
2. Thermodynamics - An Engineering Approach, Yunus A. Cengel and Michael A. Boles, 8th Edition, McGraw-Hill, 2017
3. Understanding Thermodynamics, H. C. Van Ness, Dover Publications, 1983

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22PC2AE213) METALLURGY AND MECHANICS OF MATERIALS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

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 microstructure of ferrous and non-ferrous metals and alloys
CO-2: Inspect the microstructure of steel after heat treatment
CO-3: Evaluate mechanical properties of materials
CO-4: Choose a material and an appropriate test suitable for given application

COURSE ARTICULATION MATRIX:

*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	2	-	1	2	-	2	2	-	1	2	2
CO-2	3	2	2	2	-	1	2	-	2	2	-	1	2	2
CO-3	3	2	2	2	-	1	2	-	2	2	-	1	2	2
CO-4	3	2	2	2	-	1	2	-	2	2	-	1	2	2

LIST OF PROGRAMS / EXPERIMENTS / EXERCISES:

METALLURGY:

1. Preparation and study of the microstructure of non-ferrous metals like Cu and Al
2. Preparation and study of the microstructure of plain 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. Study the microstructure of cutting tools

MECHANICS OF MATERIALS:

1. Determine mechanical properties of mild steel by conducting tension test
2. Determine the torsional rigidity and shear modulus of the given material by conducting torsion test
3. Determine the compressive strength of concrete cube

4. Determine the flexural rigidity and Young's modulus of given material by conducting bending test on cantilever or simply supported beams
5. Evaluate the hardness of given materials by conducting hardness test – Brinell's and Rockwell hardness tests
6. Evaluate the stiffness and shear modulus of the given material by conducting compression test on close coiled spring
7. Evaluate the toughness and impact strength of the given material by conducting Izod or Charpy Impact test

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22PC2AE202) AUTOMOTIVE CHASSIS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

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 of chassis systems

COURSE ARTICULATION MATRIX:

*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	3	-	1	-	2	1	1	3	2	-	1	3	1
CO-2	2	3	-	1	-	2	1	1	3	2	-	1	3	1
CO-3	2	3	-	1	-	2	1	1	3	2	-	1	3	1

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22SD5DS203) PYTHON PROGRAMMING AND PRACTICE

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

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 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

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	2	1	1	1	1	-	-	1	-	1	1	-	2
CO-2	2	2	1	1	1	1	-	-	1	-	1	1	-	2
CO-3	2	2	2	1	1	2	-	-	1	-	1	1	-	2
CO-4	2	3	2	1	1	2	-	-	1	-	1	1	-	2

LIST OF PROGRAM MODULES AND EXERCISES:

1. BASICS:

a) Running instructions in Interactive interpreter and a Python Script.
b) Write a program to purposefully raise Indentation Error and correct it.

2. OPERATIONS:

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

3. CONTROL FLOW:

a) Write programs using for loop that loops over a sequence.
b) Write a Program for checking whether the given number is even or odd.
c) Write a Program to Print the Fibonacci sequence using while loop.
d) Write a program to print all prime numbers in a given interval (use break.)

4. LISTS:

a) Write a program to find mean, median, mode for the given set of numbers in a list.
b) Write a program to convert a list and tuple into arrays.
c) Write a program to find common values between two arrays.

5. DICTIONARY:

a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
b) Write a program combine lists into a dictionary.

6. STRINGS:

a) Write a program to check whether a string starts with specified characters.
b) Write a program to check whether a string is palindrome or not.
c) Write a program to split and join a string.
d) Write a Program to Sort Words in Alphabetic Order.

7. FILES:

a) Write a program to print each line of a file in reverse order.
b) Write a program to compute the number of characters, words and lines in a file.
c) Write a program to count frequency of characters in a given file.

8. FUNCTIONS:

a) Write a function to implement Simple Calculator program.
b) Write a function to Find the factorial of a number using recursion.
c) Write a function dups to find all duplicates in the list.
d) Write a function unique to find all the unique elements of a list.
e) Write a function cumulative_ product to compute cumulative product of a list of numbers.
f) Write a function reverse to print the given list in the reverse order.
g) Write function to compute GCD, LCM of two numbers.

9. MULTI-D LISTS:

a) Write a program that defines a matrix and prints.
b) Write a program to perform addition of two square matrices.
c) Write a program to perform multiplication of two square matrices.

10. DATA SCIENCE:

a) Install NumPy package and explore it.
b) Install Pandas and explore Pandas data frame related operations (Reading files, Data preparation and preprocessing).
c) Install Matplotlib, seaborn packages and explore various plots.

11. DATA ANALYSIS AND CASE STUDY:

a) Exploratory data analysis.
b) Case Study on Classification and Regression.

12. DIGITAL LOGIC:

a) Write Python programs to implement Digital Logic Gates–AND, OR, NOT, EX-OR.
b) Write Python programs to implement Half Adder, Full Adder, and Parallel Adder.

TEXT BOOKS:

1. Python for Everybody: Exploring Data in Python 3, Charles Severance, 1st Edition, Shroff Publishers, 2017
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson, 1st Edition, 2018

REFERENCES:

1. Learning Python, Mark Lutz, 5th Edition, Orielly, 2013
2. Think Python: How to Think Like a Computer Scientist, Allen Downey, Shroff, 2nd Edition, O'Reilly, 2016
3. Core Python Programming, W. Chun, 1st Edition, Pearson Education, 2007
4. Fundamentals of Python: First Programs (Introduction to Programming), Kenneth A. Lambert, South-Western College Publishing, 2011

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22SD5AE202) FIELD PROJECT

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME		
CIE	SEE	TOTAL
50	-	50

COURSE OBJECTIVES:

- To identify, analyze and solve industry / technical / societal problems creatively through sustained critical investigation
- To practice the skills, elegance and commitment to excellence needed to engage in lifelong learning
- To demonstrate an awareness and application of appropriate personal, social and professional ethical standards

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

CO-1: Understand the formulated industry / technical / societal problems

CO-2: Apply fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study

CO-3: Demonstrate skills and knowledge of current information, technological tools and techniques specific to the professional field of study

CO-4: Analyze and / or develop models for providing solution to industry / technical / societal problems

CO-5: Use effectively oral, written and visual communication

COURSE ARTICULATION MATRIX:

(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial)**

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	-	-	-	-	3	3	-	3	-	1	3	-	-
CO-2	3	3	2	2	3	2	-	-	3	-	2	3	-	-
CO-3	-	-	3	-	3	2	-	2	3	3	3	3	-	-
CO-4	2	3	3	3	3	3	3	3	3	-	3	3	-	-
CO-5	-	-	-	-	2	-	-	3	3	3	-	3	-	-

COURSE OUTLINE:

Filed project-based learning offers students real world opportunities to research issues, think critically, gain new perspectives, solve problems and develop written and oral communication skills all within the framework of a team environment and guided by engaged and involved faculty

- A student shall undergo a one credit Field Project course in II year.
- It shall be a project based course involving the student to undertake issues for industries, companies, and any organizations which they encounter in their day-to-day work.
- Evaluation of the field project shall consist of Continuous Internal Evaluation (CIE) only for 50 marks.
- CIE shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the specialization / department.
- The internal evaluation shall be on the basis of two seminars for 50 marks one before SE-I and the other before SE-II as per the calendar dates and evaluation format.
- CIE shall be carried out for 50 marks on the basis of review presentation as per the calendar dates and evaluation format.
- The field project report shall be accepted for submission to the PRC only upon meeting the prescribed similarity index of less than 25%.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22MN6HS103) HAPPINESS AND WELLBEING

TEACHING SCHEME		
L	T/P	C
2	0	0

EVALUATION SCHEME			
SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To learn sustainable strategies to develop positive attitude and happy heart
- To develop self-awareness and self-discipline to meet the needs of happiness
- To practice good health & mindfulness for wellbeing
- To adapt personality attributes of happiness and success strategies
- To nature happiness development index for better living

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

CO-1: Recognize what is happiness in life and how to sustain it

CO-2: Focus on interpersonal skills for a mindful approach

CO-3: Develop to mindfulness to handle challenging situations

CO-4: Recognize the importance of positive attitude for personal and professional development

CO-5: Interpret the need for nurturing happiness development index through Indicators

COURSE ARTICULATION MATRIX:

*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	3	-	2	1	-	-	3	-	-
CO-2	-	-	-	-	-	3	-	3	1	-	-	3	-	-
CO-3	-	-	-	-	-	1	-	1	1	-	-	3	-	-
CO-4	-	-	-	-	-	2	-	2	1	-	-	3	-	-
CO-5	-	-	-	-	-	3	-	1	1	-	-	3	-	-

UNIT-I:

Introduction to Happiness: Definition & theories of happiness: Hedonism theory, Desire theory, Objective list theory. Identifying potential barriers of happiness: Devaluing happiness, chasing superiority, being needy, being overly control-seeking, distrusting others, distrusting life, and ignoring the source within. Strategies for overcoming the potential barriers

UNIT – II:

Power of Emotions & Relationships: Role of emotional intelligence, self-awareness, and empathy in creating harmonious relationship with ourselves and others. Balancing emotions. Hormones that promote happiness. The importance of social connections for happiness. Role of share & care, gratitude, forgiveness & kindness in building relationships

UNIT – III:

Health and Wellbeing: The link between health & happiness-exercise regularly, eat a healthy diet, get enough sleep for physical fitness. Mental wellbeing-Take notice, keep learning, stay connected with nature, and financial wellbeing. The practice of mindfulness and its benefits for mental and physical health. Moving from restlessness to restfulness- meditation and yoga to increase awareness and reduce stress

UNIT – IV:

Re-wirement for Wellbeing: Abundance in life, freedom of choice, accepting change, ways of implementation for wellbeing: practicing habits-be proactive, begin with end-in-mind, put-first things-first, think win-win, seek first to understand then to be understood, synergize, sharpen the saw, and effectiveness to greatness

UNIT – V:

Nurturing Happiness Development Index: Exploring the sources of temporary joy and lasting happiness. Acceptance, Appreciation, forgiveness, gracefulness, and creative procrastination. Time management with four D's (delete, delay, delegate, do). Developing happiness index-track changes in happiness levels over time and identify the indicators

TEXT BOOKS:

1. The How of Happiness: A Scientific Approach to Getting the Life You Want, Sonja Lyubomirsky, Penguin Books, 2008
2. Authentic Happiness: Using the New Positive Psychology to Realize Your Potential for Lasting Fulfilment, Martin Seligman, Atria Books, 2004
3. The Book of Joy: Lasting Happiness in a Changing World, Dalai Lama, Desmond Tutu, and Douglas Abrams, Avery, 2016

REFERENCES:

1. 7-Habits of Highly Successful People, Stephen Covey, Simon & Schuster, 2020
2. Mindfulness Book of Happiness: Mindfulness and Meditation, Aimen Eman, Publish Drive Edition, 2018
3. Mindfulness at Work: How to Avoid Stress, Achieve More and Enjoy Life, Dr. Stephen McKenzie, Exisle Publishing, 2014
4. The 8th Habit: From Effectiveness to Greatness, Stephen R. Covey, Free Press, 2004

ONLINE RESOURCES:

1. Life of Happiness And Fulfillment, Indian School of Business, Coursera https://in.coursera.org/learn/happiness
2. Science of Wellbeing, Yale University, Coursera, https://www.coursera.org/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22HS1MG201) ENGINEERING ECONOMICS AND ACCOUNTANCY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the basic concepts of economics and different forms of business organizations
- To create awareness on basics of business economics and to analyse the concepts of demand and supply
- To describe each stage of product life cycle with the help different costs and their role in maintaining optimum cost of production and overall profitability by considering different market competitions
- To acquaint with the basic accounting knowledge and financial accounting process
- To evaluate the performance of the organization using various ratios

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

CO-1: Perform decision making function effectively in an uncertain framework by applying the based concepts of economics and select suitable form of business organization which meets the requirements of business

CO-2: Take the right decisions towards buying and selling of goods and services based on the demand and supply dynamics in the markets

CO-3: Fix the right price based upon production cost which can best meet the pre-determined objectives of the business under different market conditions

CO-4: Prepare book of accounts and understand overall position of the business

CO-5: Interpret the firm's financial performance using various ratios

COURSE ARTICULATION MATRIX:

*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	-	-	-	-	-	-	1	2	1	3	1	-	-	-
CO-2	-	-	-	-	-	-	-	1	2	1	3	1	-	-	-
CO-3	-	-	-	-	-	-	-	1	2	1	3	1	-	-	-
CO-4	-	-	-	-	-	-	-	1	2	1	3	1	-	-	-
CO-5	-	-	-	-	-	-	-	1	2	1	3	1	-	-	-

UNIT-I:

Introduction to Economics: Definition, nature, scope and types of Economics. National Income (NI) & types of Inflation.

Forms of organizing Private and Public-Sector Business Enterprises:
Private Sector Business Enterprises: (i) Sole Proprietorship – Definition, features, merits, limitations & suitability. (ii) Partnership – Definition, Partnership Act, features, types, merits, limitations, suitability. (iii) Joint-Stock Company – Definition, Companies Act, features, types, merits, limitations, suitability**.**
Public Sector Business Enterprises: Definition, features, objectives, merits, problems

UNIT-II:
Business Economics: Definition, nature and scope, linkages with other disciplines.
Demand Analysis: Law of Demand, Factors affecting demand; Elasticity of Demand-Types Measurement, Factors affecting and Significance,
Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.
Supply Analysis: Determinants of Supply, Supply function and Law of Supply.

UNIT-III:
Production, Cost, Market Structures & Pricing:
Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions - Cobb-Douglas.
Cost Analysis: Types of Costs, Short run and long run Cost Functions.
Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.
Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis (Simple problems)

UNIT-IV:
Introduction to Financial Accounting: Definition, basic principles and double-entry book-keeping, practice of accounting process-Journal, ledger, trial balance and final accounts (simple problems)

UNIT-V:
Ratio Analysis: Meaning, computation of ratios (i) Liquidity Ratios: Current Ratio and Quick Ratio, (ii) Solvency Ratios: Interest Coverage Ratio and Debt-Equity Ratio, (iii) Activity Ratios: Stock/Inventory Turnover Ratio and Debt Turnover Ratio, (iv) Profitability Ratios: Gross Profit Ratio, Net Profit Ratio & Earning Per Share (EPS) Ratio

TEXT BOOKS:

1. Managerial Economics, D. M. Mithani, 9th Edition, Himalaya Publishing House, 2022
2. Managerial Economics, Satya P. Das & J. K. Goyal, 2nd Edition, Sage Publications, 2022
3. Financial Accounting, S. N. Maheswari, 6th Edition, Vikas Publications, 2018

REFERENCES:

1. Managerial Economics, Dominick Salvatore, Siddhartha K. Rastogi, 9th Edition, Oxford Publications, 2020
2. Financial Accounting for Management: An Analytical Perspective, Ambrish Gupta, 6th Edition, Pearson Education, 2018
3. Business Economics, H. L. Ahuja, 13th Edition, S. Chand & Co., 2019

4. Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshan ul Haque, 13th Edition, Pearson Education/ Prentice Hall of India, 2010

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22PC1AE206) AUTOMOTIVE ENGINES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Physics and Chemistry

COURSE OBJECTIVES:
- To present the constructional details and combustion in automotive engines
- To learn the principle and working of sensors, actuators and electronic fuel injection
- To know functionality of engine sub-systems
- To provide the engine performance characteristics and modern concepts of 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: Present working principle of sensors, actuators and electronic fuel injection
CO-3: Describe the functionality of engine sub-systems
CO-4: Discuss the engine performance characteristics and modern concepts of engines

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	2	1	2	-	2	2	-	-	1	-	1	3	2
CO-2	2	2	1	3	-	2	2	-	-	1	-	1	2	3
CO-3	2	2	1	3	-	2	3	-	-	1	-	1	2	2
CO-4	2	2	1	3	-	2	3	-	-	1	-	1	2	3

UNIT-I:
Engine: Classification and components of an engine, principle and working of four stoke and two stroke SI and CI engines, theoretical and actual indicator, valve and port timing diagrams and theoretical and actual cycles-analysis.
Engine Construction: Cylinder head, cylinder block, cylinder liner, piston and piston ring - types, connecting rod, crank shaft, crank case, sump, valves, valve seat inserts, valve actuating mechanisms and variable valve timing.

UNIT-II:
Fuel System: Fuels-chemical structure of petroleum, important qualities of engine fuels, rating of fuels. Air fuel ratio requirements of SI and CI engines, principle and working of simple carburettor, Diesel fuel injection pump and types of nozzles.

Engine Combustion: Concepts of combustion-combustion equations, heat of combustion. Petrol engine - Ignition limits, stages of combustion, effect of engine variables, knocking and detonation - theory, parameters affecting and control, combustion chamber - different types and design. Diesel engines – stages of combustion, knocking and detonation - theory, parameters affecting and control, combustion chamber - different types.

UNIT–III:

Engine Sensors and Actuators: sensors – engine speed, mass air flow, manifold absolute pressure, throttle position, knock, temperature and exhaust oxygen level, actuators - solenoids, relays and stepper motors,

Electronic Fuel Injection: Necessity, throttle body fuel injection, multi- point fuel injection and gasoline direct injection and common rail direct injection.

UNIT–IV:

Cooling and Lubrication: Necessity of cooling, coolant requirements, 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.

Supercharging and Turbocharging: Necessity of supercharging, mechanical supercharging and turbocharging, compressors and turbines for supercharging, degree of supercharging, methods of supercharging and efficiency of supercharged engine.

UNIT–V:

Engine Performance: Engine power, measurement of friction power, engine efficiencies, performance characteristics, variables affecting the performance characteristics and heat balance, performance maps and analytical method of performance estimation.

Modern Trends in IC Engines: Variable compression ratio engine - Necessity, different methods. Concepts of HCCI engine, stratified charge engine and lean burn engine, camless engine.

TEXT BOOKS:

1. Internal Combustion Engine Fundamentals, John B. Heywood, 2nd Edition, McGraw-Hill, 2018
2. Internal Combustion Engines, Ganesan V., 4th Edition, McGraw-Hill, 2017
3. Internal Combustion Engines, Mathur M. L. and Sharma R. P., Dhanpat Rai Publications, 2018

REFERENCES:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, 2002
2. Fundamentals of Internal Combustion Engines, H. N. Gupta, 2nd Edition, Prentice Hall India, 2012
3. Introduction to Internal Combustion Engines, Richard Stone, SAE,1999
4. Internal Combustion Engine, Willard W. Pulkrabek, Prentice Hall, 1997

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22PC1AE207) THEORY OF MACHINES AND MECHANISMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

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 and enumerate different link-based mechanisms with basic understanding of kinematic and dynamic motions
CO-2: Apply suitable drives and evaluate performance effects of gyroscopic couple
CO-3: Illustrate various power transmission mechanisms
CO-4: Evaluate the performance of governors

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	3	2	-	-	-	-	-	-	-	3	2
CO-2	3	3	2	3	2	-	-	-	-	-	-	-	3	2
CO-3	3	3	2	3	2	-	-	-	-	-	-	-	3	2
CO-4	3	3	2	3	2	-	-	-	-	-	-	-	3	2

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.

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

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 and hunting of governors.

TEXT BOOKS:

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

REFERENCES:

1. Theory of Machines, Thomas Bevan, 3rd Edition, Pearson Education, 2009
2. Theory of Mechanisms and Machines, Ghosh A. and Mallick A. K., East-West, 1988
3. Design of Machinery, Robart L. Norton, 3rd Edition, McGraw-Hill, 2004
4. Theory of Machines, Sadhu Singh, 3rd Edition, Pearson Education, 2011
5. Theory of Machines, Ballaney P. L., Khanna Publishers, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22PC1AE208) FLUID MECHANICS AND HEAT TRANSFER

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Mechanics and thermodynamics

COURSE OBJECTIVES:
- To understand the properties of fluids and types of flows
- To evaluate of types of fluid forces and dynamic flows
- To measure the conduction mode of heat transfer in physical environment and to derive general mathematical equation and extended surfaces
- To measure convective mode of heat transfer and through different types of heat exchangers, heat transfer during radiation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and obtain the values of fluid properties, relationship between them and understand the principles of continuity
CO-2: Apply Bernoulli's equation to fluid flow application
CO-3: Apply the concepts of heat conduction and convection to physical system
CO-4: Apply the concepts of heat exchanger and radiation to physical system

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	1	-	1	2	-	-	-	-	-	2	1
CO-2	3	2	1	1	-	1	2	-	-	-	-	-	2	1
CO-3	3	2	1	1	-	1	2	-	-	-	-	-	2	1
CO-4	3	2	1	1	-	1	2	-	-	-	-	-	2	1

UNIT – I:
Fluid Statics: Properties of fluid – mass density, specific weight, specific gravity, viscosity, surface tension, fluid pressure at a point and measurement of pressure.
Fundamentals of Fluid Flow: Introduction, types of fluid flow, acceleration of a fluid particle, continuity equation, stream function and velocity potential function.

UNIT – II:
Equation of Motion and Energy Equation: Forces acting on fluid in motion – Euler's equation of motion and Bernoulli's equation of motion, applications of Bernoulli's equation, venturimeter, pitot tube. Reynolds experiment –Darcy Weisbach equation and classification of losses in pipes.

UNIT – III:

Introduction: Modes of heat transfer – conduction, convection and thermal radiation- Basic laws of heat transfer - Fourier heat conduction equation - general heat conduction equation in Cartesian, cylindrical and spherical coordinates.

One Dimensional Steady State Heat Conduction: Composite systems and extended surfaces-long fin.

UNIT – IV:

Convective Heat Transfer: Introduction, the boundary layer concepts about hydrodynamic and thermal boundary layers, non-dimensional correlation for convection heat transfer significance of non -dimensional numbers and use of empirical correlations for convective heat transfer.

Forced Convection: Flow over a flat plates and fully developed flow in circular tubes.

Free Convection: Flow over a vertical plate.

UNIT – V:

Heat Exchangers: Types of heat exchangers - problems using LMTD and NTU methods for parallel flow and counter flow.

Radiation Heat Transfer: Laws of black body radiation- Planck, Wien, Kirchhoff, Stefan and Boltzmann - heat exchange between two black bodies and concepts of shape factor.

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics Including Hydraulics Machines, P. N. Modi, S. M. Seth, 23rd Edition, Standard Book House, 2022
2. Fundamentals of Engineering Heat and Mass Transfer, Sachdeva R. C., 5th Edition, New Age International, 2017

REFERENCES:

1. Fluid Mechanics, Fundamentals & Applications, Yunus A. Çengel, John M. Cimbala, 4th Edition, McGraw-Hill, 2019
2. Fluid Mechanics, F. M. White, McGraw-Hill, 2022
3. Heat Transfer: A Basic Approach, Ozsik, McGraw-Hill, 1985
4. Fundamentals of Heat & Mass Transfer, Incopera, Dewitt, Wiley, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22PC1AE209) APPLIED THERMODYNAMICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

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

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	2	-	-	-	-	-	1	-	1	2	1
CO-2	3	3	3	2	1	2	2	-	1	1	-	1	2	1
CO-3	3	3	2	2	1	-	1	-	1	1	-	1	2	1

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 efficiency and equivalent evaporation.
Steam Condensers: Introduction, purpose, types of condensers and efficiency of condenser.

UNIT – II:
Steam Nozzles: Functions of nozzle, applications, types, flow through nozzles, thermodynamic analysis, assumptions, ideal and actual expansion in nozzle, velocity co-efficient, condition for maximum discharge and critical pressure ratio.
Steam Turbines: Mechanical details, velocity diagram, effect of friction, power developed, axial thrust, diagram efficiency, condition for maximum efficiency of simple impulse turbine, methods to reduce rotor speed, Degree of reaction, Parson's reaction turbine and condition for maximum efficiency of Parson's turbine.

UNIT – III:

Reciprocating Compressors: Principle of operation, isothermal efficiency, volumetric efficiency and effect of clearance, multistage compression, under cooling, saving of work and condition for minimum work in multi stage compression.

Rotary Compressors: Classification, roots blower, vane blower, centrifugal compressor and axial compressor (Qualitative treatment only).

UNIT – IV:

Gas Turbines: Classification of gas turbines, 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 – V:

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.

TEXTBOOK:

1. Thermal Engineering, Mahesh Rathore, McGraw-Hill, 2010

REFERENCES:

1. Thermal Engineering, Rajput R. K., 11th Edition, Laxmi Publications, 2020
2. Thermodynamics and Heat Engines, Yadav R., Central Publishing House, 2002

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22PC2AE206) AUTOMOTIVE ENGINES LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Automotive Engine Operation and Working of Engine Systems

COURSE OBJECTIVES:
- To illustrate valve and port timing diagrams
- To testing and performance of IC engines and compressor
- To estimate heat balancing and optimum cooling of an engine
- To find the frictional power of an engine

COURSE OUTCOMES: After completion of the course the student should be able to
CO-1: Demonstrate valve and port timing diagrams
CO-2: Evaluate performance of IC engines and compressor
CO-3: Perform heat balancing and optimum cooling of an engine
CO-4: Determine frictional power of an engine

COURSE ARTICULATION MATRIX:
*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	2	1	1	1	2	2	1	1	1	-	1	3	2
CO-2	2	2	1	1	2	2	2	1	1	1	-	1	2	3
CO-3	2	2	1	1	1	2	3	1	1	1	-	1	2	2
CO-4	2	2	1	1	1	2	3	1	1	1	-	1	2	3

LIST OF EXPERIMENTS: (Any ten experiments)
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. Performance test on 4-Stroke multi-cylinder petrol engine
7. Morse test on multi-cylinder petrol engine
8. Heat balance test on 4-Stroke single cylinder Diesel engine
9. Optimum cooling temperature test on single cylinder Diesel engine
10. Retardation test on 4-Stroke single cylinder Diesel engine
11. Performance test on computerised Diesel engine
12. Permanence test on reciprocating compressor test rig

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22PC2AE207) THEORY OF MACHINES AND MECHANISMS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

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 types of governors

COURSE ARTICULATION MATRIX:

*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	3	2	1	1	1	1	1	-	1	3	2
CO-2	3	3	2	3	2	1	1	1	1	1	-	1	3	2
CO-3	3	3	2	3	2	1	1	1	1	1	-	1	3	2
CO-4	3	3	2	3	2	1	1	1	1	1	-	1	3	2

LIST OF PROGRAMS / EXPERIMENTS / EXERCISES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22PC2AE208) FLUID MECHANICS AND HEAT TRANSFER LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Fluid Mechanics, Heat Transfer and Thermodynamics

COURSE OBJECTIVES:

- To evaluate the heads 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, venture
- To measure heat transfer through conduction and radiation
- To measure heat transfer through natural, forced convection and heat exchanger

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

CO-1: Apply the Bernoulli's equation to fluid flow problems

CO-2: Estimate the major and minor losses in pipe flows

CO-3: Evaluate the heat conduction and radiation parameters

CO-4: Determine convection coefficient in natural and forced convection and performance of heat exchanger

COURSE ARTICULATION MATRIX:

*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	1	-	1	2	1	1	1	-	1	2	1
CO-2	3	2	1	1	-	1	2	1	1	1	-	1	2	1
CO-3	3	2	1	1	-	1	2	1	1	1	-	1	2	1
CO-4	3	2	1	1	-	1	2	1	1	1	-	1	2	1

LIST OF PROGRAMS / EXPERIMENTS / EXERCISES:

1. Verification of Bernoulli's theorem
2. Calibration of Venturi meter
3. Determination of friction factor for a given pipe
4. Determination of Minor losses for the given equipment
5. Thermal conductivity of Metal bar
6. Determination of thermal conductivity of insulating powder
7. Determination of thermal conductivity of composite wall
8. Determination of heat transfer coefficient in natural convection apparatus
9. Determination of heat transfer coefficient in force convection apparatus
10. Determination of Stefan Boltzmann constant
11. Measurement of emissivity of given test plate
12. Determination of effectiveness of heat exchanger

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester

(22PW4AE201) DESIGN THINKING

TEACHING SCHEME		
L	T/P	C
1	2	2

EVALUATION SCHEME		
CIE	SEE	TOTAL
40	60	100

COURSE OBJECTIVES:

- To instill a sense of significance towards applying creativity to product and service design
- To teach a systematic approach to identifying and defining a problem before brainstorming for a solution
- To inculcate core design principles and applied creativity to develop innovative strategies that better connect engineers and technologies with their end users
- To build a mindset leading to flow of creative ideas, validating those ideas and prioritizing the best ones among them
- To motivate students to apply design thinking while implementing projects focusing on local, regional or global societal problems

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

CO-1: Demonstrate the understanding of design principles from a technology perspective

CO-2: Validate problem statements through user empathisation with societal, cultural, global and environmental consciousness

CO-3: Use specific and relevant ideation and brainstorming techniques to find innovative solutions

CO-4: Prototype a solution to address user challenges

CO-5: Investigate the cultural, emotional, environmental, technological and business factors relevant to developing new product or service design concept

COURSE ARTICULATION MATRIX:

*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	2	-	-	2	-	-	3	3	1	1	-	2
CO-2	-	-	3	2	1	3	-	-	3	2	1	1	2	1
CO-3	-	-	2	-	-	2	-	-	2	2	3	-	-	-
CO-4	-	-	3	-	2	-	-	-	2	3	1	-	-	1
CO-5	-	-	-	3	-	3	1	-	1	-	1	-	-	-

UNIT-I:

Design Overview and Doing Design: Various perspectives of design, Good and Bad Design, Introduction to the Design Double Diamond: Discover-Define-Develop-Deliver, Discover Phase- Looking for problems, Identifying Stakeholders and Defining User Personas, User Empathization, Data collection, creating and conducting surveys and Empathy Tools – What/How/Why, Five Why method, Empathy Maps, AEIOU method, Story Share and Capture.

UNIT-II:

Need Analysis: Types of Users, Types of Needs, Market Size, Value Proposition to the Users, Identifying Addressable Needs and Touch points, Structuring Need Statements, Customer Experience (CX) Design, Service Design and Development Process, Customer Journey Map (CJM), Service Experience Cycle.

UNIT-III:

Ideation Process: Introduction to creativity and closed-world solutions, Idea generation techniques: Brainstorming, Mind Maps, SCAMPER, Systematic Inventive Thinking methods (Subtraction, Multiplication, Division, Task Unification and Attribute Dependency),

Strategic Innovation for Competition in Future: Linear Innovation vs. Non-linear innovation, Understanding and identifying weak signals, 3-box thinking, 3-Box framework and Box-3 ideation, Four-Action Framework (Eliminate-Reduce-Raise-Create, or ERRC Matrix).

UNIT -IV:

Building Prototypes: Building Conceptual model of product/service using various prototype methods, test a business model or business case to support the viability of the solution using MVP.

Design for Sustainability: Concern for Environment and Sustainability in Design, Case Studies to understand good Design For Environment (DFE) Decisions, Sustainable Design Approaches in the five stages of the Product Life Cycle.

UNIT -V:

Capstone Project (Interdisciplinary): Applying design thinking principles and methods for problem definition, ideation, prototyping, testing, refining and taking the solution to the users, using visual representation tools to indicate problem, User persona, needs, empathisation, ideas and prototype that leads to chosen solution, creating presentation.

TEXT BOOKS:

1. Change by Design, Tim Brown, Harper Business, 2012
2. The Design of Everyday Things, Donald A. Norman, MIT Press, 2013

REFERENCES:

1. The Art of Innovation, Tom Kelly, Jonathan Littman, Harper Collins Business, 2002
2. Design Thinking: Integrating Innovation, Customer Experience, and Brand Value, Thomas Lockwood, Allworth Press, 2009
3. Design Thinking for Start-ups: A Handbook for Readers and Workbook for Practitioners, Jimmy Jain, Notion Press, 2018

ONLINE RESOURCES:

1. https://www.ideou.com/pages/design-thinking
2. https://www.ibm.com/design/thinking/page/framework
3. https://onlinecourses.nptel.ac.in/noc20_mg38/preview
4. https://nptel.ac.in/courses/110106124
5. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking- process

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

(22MN6HS201) INTELLECTUAL PROPERTY RIGHTS

TEACHING SCHEME

L	T/P	C
2	0	0

EVALUATION SCHEME

SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To familiarize students with the nuances of Intellectual Property Rights (IPR) to help them integrate the IPR process in their research activities
- To make the students capable of identifying their own protectable innovations and realizing the process of taking it from bench to market

COURSE OUTCOMES: After completing this course the student should be able to

CO-1: Get an adequate knowledge on patent and copyright for their innovative research works and academic projects

CO-2: Understand and acquire the knowledge of trademarks and registration aspects

CO-3: Interpret various forms of Intellectual Property on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

CO-4: Obtain useful insights from the information in patent documents, especially on novelty of their idea from state-of-the art search, during their research career. This provides further way for developing their idea or innovations

CO-5: Get awareness about current trends in IPR and Govt. steps in fostering IPR

COURSE ARTICULATION MATRIX:

*(Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	2	-	3	-	-	-	2	-	-
CO-2	-	-	-	-	-	2	-	3	-	-	-	2	-	-
CO-3	-	-	--	-	-	2	-	3	-	-	-	2	-	-
CO-4	-	-	-	-	-	2	-	3	-	-	-	2	-	-
CO-5	-	-	-	-	-	2	-	3	-	-	-	2	-	-

UNIT – I:

Overview of Intellectual Property: Introduction and the need for Intellectual Property Right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

UNIT – II:

Patents: Patents - Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

UNIT – III:

Copyrights: Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

UNIT – IV:

Trademarks:

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

UNIT – V:

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

Plant Variety Protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection

Layout Design Protection: meaning – Procedure for registration, effect of registration and term of protection

Current Contour: India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies

TEXTBOOKS:

1. Intellectual Property Rights: Protection and Management Nithyananda, K V, India, IN: Cengage Learning India Private Limited, 2019
2. Intellectual Property Rights, Neeraj, P., & Khusdeep, D, India, IN: PHI learning Private Limited, 2014
3. Intellectual property right, Deborah, E. Bouchoux, 4th Edition, Cengage learning

REFERENCE:

1. Law relating to Intellectual Property Rights, Ahuja, V K, India, IN: Lexis Nexis, 2017

ONLINE RESOURCES:

1. Intellectual Property Rights – An Overview, Subramanian, N., & Sundararaman, M. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf, 2018
2. WIPO Intellectual property Handbook, World Intellectual Property Organisation, Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf, 2004