

Syllabus of 4th Sem Mechanical Engineering





Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI BHAGWATI COLLEGE OF ENGINEERING, NAGPUR
 An Autonomous Institution Affiliated to R.T.M. Nagpur University, Nagpur
 Accredited with Grade 'A' by NAAC



B. Tech. Mechanical Engineering
Scheme of Examination & Syllabus
SEMESTER IV

SCHEME : BTECH/ME/NEP/24

Sr. No	Course Category	Course Code	Course Title	Teaching Scheme (Hours/Week)			Credits	Maximum Marks			Minimum Marks			End Semester Exam Duration (Hrs)
				L	T	P		Continuous Evaluation	End Semester Exam	Total Marks	Continuous Evaluation	End Semester Exam	Total Marks	
1		ME401T	Engineering Thermodynamics	3	--	--	3	40	60	100	--	15	45	3
2		ME402T	Fluid Mechanics and Hydraulic Machines	3	--	--	3	40	60	100	--	15	45	3
3	PCC	ME402P	Lab - Hydraulic Machines	--	--	2	1	25	25	50	--	--	25	--
4		ME403T	Manufacturing Process	2	--	--	2	20	30	50	--	8	23	2
5		ME403P	Lab - Manufacturing Process	--	--	2	1	25	25	50	--	--	25	--
6	MDM	ME404T	Multidisciplinary Minor - II (Refer Basket)	2	--	--	2	20	30	50	--	8	23	2
7	OE	ME405T	Open Elective - II (Refer Basket)	2	--	--	2	20	30	50	--	8	23	2
8	VSEC	ME406P	Lab - Python Programming	--	--	4	2	50	50	100	--	--	50	--
9	HSSM (AEC-02)	HUM407T	Ability Enhancement Course (Refer Basket)	2	--	--	2	20	30	50	--	8	23	2
10	HSSM	HUM408T	Entrepreneurship development & Management	2	--	--	2	20	30	50	--	8	23	2
11	VEC	EC409T	Digital and Technological Solutions	2	--	--	2	20	30	50	--	8	23	2
			Total	18		8	22			700				18

Abbreviations:

L-Lecture, T-Tutorial, P-Practical, PCC- Programme Core Course, PEC- Programme Elective Course, MDM- Multidisciplinary Minor, OE-Open Elective

	2025-26	2.0
		Applicable for 2025-26



PRIYADARSHINI BHAGWATI COLLEGE OF ENGINEERING, NAGPUR
DEPARTMENT OF MECHANICAL ENGINEERING
Scheme of Examination for B.Tech. in Mechanical Engineering



IV Semester

Sr. No.	Course Code	Category	BOS/ Dept	Course Name	Hours/Week			Credits			Maximum Marks			Min. Passing Marks			ESE Duration (Hrs.)
					L	T	P	Total	Continuous Evaluation	End Semester Exam	Total	Continuous Evaluation	End Sem Exam	Total			
1	ME401T	PCC	ME	Engineering Thermodynamics	3			3			40	60	100	---	15	45	03
2	ME402T	PCC	ME	Fluid Mechanics and Hydraulic Machines	3			3			40	60	100	---	15	45	03
3	ME402P	PCC	ME	Lab -Hydraulic Machines			2				25	25	50	---	---	25	--
4	ME403T	PCC	ME	Manufacturing Process	2			2			20	30	50	---	8	23	02
5	ME403P	PCC	ME	Lab - Manufacturing Process			2				25	25	50	---	15	45	--
6	ME404T	MDM	ME	MDM02: Introduction to Robotics	2			2			20	30	50	---	8	23	02
7	ME405T	MC-OE	ME	Open Elective-02	2			2			20	30	50	---	8	23	02
8	ME406P	SC-VSEC	ME	Lab - Python Programming			4				50	50	100	---	---	50	--
9	HUM407T	HSSM-(AEC-02)	ASH	Ability Enhancement Course Professional Communication	2			2			20	30	50	---	8	23	02
10	HUM408T	HSSM EMC	ASH	Entrepreneurship Development and Management	2			2			20	30	50	---	8	23	02
11	HUM409T	HSSM VEC	ASH	Digital and Technological Solution	2			2			20	30	50	---	8	23	02
Total					18		8	22					700				18

Open Elective-02

Automobile Engineering ME405AT	Project Evaluation & Management ME405BT	Waste Management ME405CT
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Theory	Practical
08	03

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 Mechanical Engineering Department
 Priyadarshini Bhagwati College
 of Engineering, Nagpur



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DEPARTMENT OF MECHANICAL ENGINEERING
 SYLLABUS OF SECOND YEAR BACHELOR OF TECHNOLOGY,
 SEMESTER IV
COURSE AS PER NEP

COURSE:- ENGINEERING THERMODYNAMICS
 COURSE CODE: ME401T

Hours/ Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 3Hrs.	3	3 Hrs.	30 ⁴⁰	70 ⁶⁰	100

Course Objectives:

1.	To introduce the fundamental concepts, laws, and properties of thermodynamics, enabling students to understand energy interactions through heat and work in engineering systems.
2.	To develop the ability to apply the first and second laws of thermodynamics for analyzing closed and open systems, including compressors, turbines, boilers, and other flow devices.
3.	To provide analytical skills for evaluating thermodynamic properties, entropy, and performance of various power cycles and steam-based systems used in power generation.

Course Outcomes:

After completion of the course, the student will be able to

CO1	<u>Understand</u> and explain the fundamental concepts and laws of thermodynamics and apply them to calculate heat, work, internal energy, and enthalpy for various thermodynamic processes.
CO2	Apply the first law of thermodynamics to both closed and open systems and analyze energy interactions in various steady flow devices.
CO3	<u>Understand</u> the second law of thermodynamics, evaluate the performance of heat engines, refrigerators, and heat pumps, and analyze entropy changes in various thermodynamic processes.
CO4	Interpret thermodynamic properties of steam, perform calculations using steam tables and Mollier charts, and determine the dryness fraction using calorimetric methods.
CO5	Analyze the performance of air standard cycles and vapor power cycle, and compare their efficiencies using P-v and T-s diagrams.

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SYLLABUS

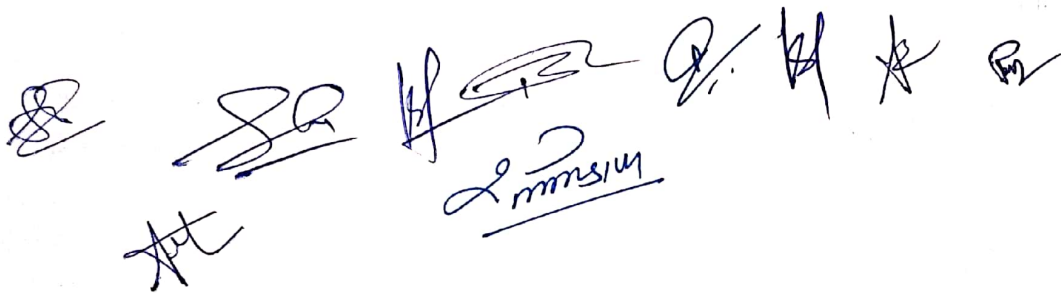
UNIT I: BASIC CONCEPTS AND THERMODYNAMIC	(8 HOURS) (14 MARKS)
<p>Basic concepts of Thermodynamics, Systems and their types, Property, State, Process, Phase, Cycles. Comparison of microscopic and macroscopic approaches. Path and point functions. Thermodynamic Equilibrium.</p> <p>Zeroth law of thermodynamics and its significance for temperature measurement Introduction to First law of thermodynamics, Energy transfer, Heat and worktransfer.</p> <p>Ideal Gas laws: Boyle's law, Charle's law, Gay-Loussac's law, Avogadro's law, Equation of state, General gas equation, Specific Heat, Universal gas constant.</p> <p>Thermodynamic Processes: Constant pressure, Constant volume, Isothermal, Isentropic and Polytropic process, representation on P-V and T-S Diagram, Calculation of Heat transfer, Work done, Change in Internal Energy and Enthalpy for these processes</p>	
UNIT – II: FIRST LAW OF THERMODYNAMICS AND APPLICATIONS	(7 HOURS) (14 MARKS)
<p>The first law of Thermodynamics: The first law of Thermodynamics for Closed System undergoing a process and cycle(Control Mass System) and Open System (Control Volume System) Steady Flow process applies to Compressor, Pump, Turbine, Boiler, Steam Nozzle, Throttling Device, Heat Exchanger, Fan and blower. (Analytical treatment on First law applied to thermodynamic processes and cycles and Steady flow energy equation applied to various flow devices is expected).</p>	
UNIT – III: SECOND LAW OF THERMODYNAMICS AND ENTROPY	(7 HOURS) (14 MARKS)
<p>Second Law of Thermodynamics:- Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat Pump, Kelvin-Planck and Clausius Statements, Perpetual Motion Machine I and II, Carnot Cycle.</p> <p>Entropy:- Clausius Inequality, Entropy, Principle of Increase of Entropy, Change in Entropy for different thermodynamics processes with T-S Diagram, Reversible and Irreversible Processes. (Simple analytical treatment on COP calculation is expected)</p>	
UNIT – IV : PROPERTIES OF STEAM	(7 HOURS) (14MARKS)
<p>Properties of Steam:- Formation of steam and its thermodynamic properties like Sensible Heat, Latent Heat, Critical State, Triple Point, Wet Steam, Dry Steam, Superheated Steam, Dryness Fraction, Enthalpy, Internal Energy of Steam, External Work Done during Evaporation, T-S Diagram, Mollier Chart, Work and Heat Transfer during various Thermodynamic Processes with steam as working fluid. Measurement of Dryness Fraction using various Calorimeters. (Analytical Treatment using steam table and Mollier chart is expected)</p>	
UNIT – V: POWER CYCLES	(7 HOURS) (14MARKS)
<p>Power Cycles: - Otto Cycle, Diesel Cycle, Dual Cycle, Brayton Cycle, Representation on P-V and T-S diagrams. The equation for work done, heat transfer, air standard efficiency, and mean effective pressure. Comparison of Otto, Diesel and Dual cycles. Introduction to simple vapour power cycle, i.e., Rankine cycle (Analytical treatment in terms of calculation Work done & efficiency analysis is expected on Otto Cycle, Diesel Cycle and Dual Cycle)</p>	

Textbooks:

1. Engineering Thermodynamics, P. K. Nag, Tata McGraw-Hill Publication.
2. Thermodynamics- An Engineering Approach, Yunus A. Cengel, Michael A. Boles, Tata McGraw- Hill Publication.
3. Engineering Thermodynamics, R. K. Rajput, Laxmi Publication.

Reference Book:

1. Thermodynamics, S. C. Gupta, Pearson Publications.
2. Engineering Thermodynamics, Gordon Rogers, Pearson Publications
3. Thermal Engineering, P. L. Ballani, Khanna Publications.
4. Engineering Thermodynamics, S. S.Khandare, Charotar Publication House.
5. Engineering Thermodynamics, D. P. Mishra, Cengage Learning Publications.

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DEPARTMENT OF MECHANICAL ENGINEERING
 SYLLABUS OF SECOND YEAR BACHELOR OF TECHNOLOGY,
 SEMESTER IV

COURSE AS PER NEP

COURSE:-FLUID MECHANICS & HYDRAULIC MACHINES
 COURSE CODE:ME402T

Hours/ Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 3Hrs.	3	3 Hrs.	30	70	100

Course Objectives:

1.	To develop an understanding of fluid statics, kinematics and dynamics in Mechanical Engineering. Learn to apply Bernoulli's Equation and momentum equation to Fluid flow systems. Study various flow measuring devices. Implement flow measurement techniques: study Pitot tubes, Venturi meters, orifice plates and interpret their applications in systems. Understand the concept of viscosity for real flows. Learn to use equations in combination with experimental data.
2.	To build an understanding of hydraulic machinery—covering their types, underlying principles, performance analysis, and comparisons. Students will develop practical skills in applying hydraulic machine technology and gain insight into its real-world importance.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Understand types and properties of fluid, to apply hydrostatic laws on submerged surfaces and analyze stability of floating body based on principles of buoyancy & flotation.
CO2	Learn a variety of pressure measurement techniques and gain proficiency in fluid flow kinematics by analyzing the behavior of moving fluids.
CO3	Comprehend, formulate, analyze, and apply the fundamental principles of fluid dynamics and the concept of viscosity in fluid flow.
CO4	Develop a comprehensive understanding of jet propulsion, including the construction and analysis of velocity triangles. Explore the principles of hydraulic machinery, focusing on impulse and reaction turbines. Gain insights into the selection criteria for hydraulic turbines, the function and design of draft tubes, and the phenomenon of cavitation in turbines.

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CO5	Develop a comprehensive understanding of hydraulic pumps, including their operating principles and design considerations.
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<p>UNIT I: FLUID PROPERTIES AND FLUID STATICS (7 HOURS) (14 MARKS)</p> <p>Fluid Properties :- Types of fluids, Mass Density, Specific Weight, Specific Gravity, Newton's Law of Viscosity, Dynamic Viscosity, Stoke's Theorem, Surface Tension, Capillarity, Compressibility, Vapour pressure.</p> <p>Fluid statics : Hydrostatic law, Pascal's law, Pressure at a point, Total pressure, Centre of pressure, Pressure on a plane surfaces (Horizontal, vertical, Inclined) , Archimedes's principle, Buoyancy and stability of floating and submerged bodies, Metacentric height.</p>
<p>UNIT – II: FLUID PRESSURE, MANOMETERS AND KINEMATICS OF FLUID FLOW (7 HOURS) (14 MARKS)</p> <p>FLUID PRESSURE: Fluid pressure and its measurements and manometers.</p> <p>Kinematics of Fluid Flow: Types of Flow , steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrotational, Fluid flow line i.e stream lines, path lines, streak lines, Continuity equation in Cartesian Coordinates.</p>
<p>UNIT – III: DYNAMICS OF FLUID FLOW AND VISCOUS FLOW (7 HOURS) (14 MARKS)</p> <p>Dynamics of fluid flow : Introduction to Navier-Stroke's Equation, Euler equation of motion along a stream line, Bernoulli's equation, application of Bernoulli's equation to venturi meter, orifice meter, pitot tube.</p> <p>Viscous Flow: Introduction to laminar and turbulent flow, Reynolds number and its Significance. Introduction to Boundary Layer Theory. Flow around Immersed Bodies: - Lift and Drag. Classification of Drag, Flow around circular cylinder and Aerofoil, Development of lift on Aerofoil.</p>
<p>UNIT – IV :PRINCIPLES AND CLASSIFICATION OF HYDRAULIC MACHINES (8HOURS) (14MARKS)</p> <p>Principles & Classification of Hydraulic Machines, Theory of turbo machines and their classification, Elements of Hydraulic Power Plant. Impulse Turbines: Principle, Constructional details of Pelton Turbine, Velocity Diagram, Design Parameters , Governing of Pelton turbine.</p> <p>Reaction Turbine: Principles of operation, Degree of reaction, Comparison over Pelton Turbine, Development of Reaction Turbines, Classification, Francis Turbine, Propeller Turbine, Kaplan Turbine, Velocity diagram and analysis, Working proportions, Design parameters, Performance characteristics, Governing Reaction Turbine, Draft tubes, Cavitation in turbine.</p>
<p>UNIT – V: CENTRIFUGAL PUMP AND POSITIVE DISPLACEMENT PUMP (7 HOURS) (14MARKS)</p> <p>Centrifugal pumps:- Principle of operation, Classification, Components of Centrifugal Pump installation, Priming, Fundamental Equation, Various Heads, Velocity triangles and their analysis or effect of outlet blade angle, Vane Shapes, Losses and Efficiencies of Pumps, Multi staging of Pumps, Design Consideration, Working Proportions, N.P.S.H., Cavitation in pumps .</p>



Positive Displacement Pumps:- Basic principle, Classification, Reciprocating Piston / Plunger Pumps:- Types, Main Components, Slip, Work Done, Indicator Diagram, Cavitations, Air vessels, Gear pump, Screw pump, Vane pump. Introduction to water Lifting Device

Textbooks:

1. Fluid Mechanics: Dr. R. K. Bansal, Lakshmi Publication (P) Ltd. New Delhi
2. Fluid Mechanics: Yunus A. Cengel- Tata McGraw-Hill.
3. Fluid Mechanics, Manish R. Moroliya & N.Z. Adkane, Sara Book Publications.
4. Fluid Mechanics & Hydraulic Machines, R. K. Rajput, S. Chand & Company Ltd.

Reference Book:

1. Fluid Mechanics and Fluid Power Engineering, Dr. D.S. Kumar, S.K. Kataria & sons
2. Fluid Mechanic by Frank White and Henry Xue, McGraw-Hill.
3. Hydraulic and Fluid Mechanics, Modi P.N. and Seth S.M., Standard Book House.

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DEPARTMENT OF MECHANICAL ENGINEERING
 SYLLABUS OF SECOND YEAR BACHELOR OF TECHNOLOGY,
 SEMESTER IV
COURSE AS PER NEP

COURSE:- HYDRAULIC MACHINES LAB
 COURSECODE: ME402P

Hours/Week	Credits	Duration of End Sem Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	1	--	25	25	50

Course Objectives:

1.	To provide experimental understanding of fluid properties, flow measurement devices, and verification of basic fluid mechanics principles.
2.	To develop practical knowledge of the construction, operation, and performance testing of hydraulic turbines and pumps.
3.	To enable students to evaluate performance parameters, efficiencies, and characteristics of different hydraulic machines under varying operating conditions.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Verify fundamental fluid mechanics laws and determine coefficients of flow measuring devices such as venturi meter, orifice meter, and rotameter.
CO2	Conduct performance tests on hydraulic turbines and pumps to determine efficiency and operational characteristics.
CO3	Interpret experimental data to assess the behavior and suitability of hydraulic machines for different engineering applications.

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Course Content:**List of practical****Note: Any 08 experiments should be included in the Journal**

1. To determine the metacentric height of a given floating vessel.
2. To verify Bernoulli's theorem.
3. To find the value of co-efficient of given venture meter fitted in a pipe.
4. To find the value of co-efficient of Discharge for a given orifice meter.
5. To measure the rate of flow of liquid using Rotameter.
6. Performance characteristics of Pelton wheel.
7. Performance characteristics of Francis Turbine.
8. Performance characteristics of Kaplan Turbine.
9. Performance characteristic of Variable Centrifugal speed pump
10. Performance characteristics of Reciprocating pump.
11. Performance characteristic of Axial Flow pump.

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DEPARTMENT OF MECHANICAL ENGINEERING
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 SEMESTER IV
COURSE AS PER NEP

COURSE: - MANUFACTURING PROCESS

COURSE CODE: ME403T

Hours/ Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	2	2 Hrs.	20	30	50

Course Objectives:

1.	To impart fundamental knowledge of various manufacturing processes such as casting, joining, and forming, including their principles, tools, and applications.
2.	To develop understanding of process parameters, equipment, materials, and quality aspects involved in manufacturing techniques like moulding, welding, and metal forming.
3.	To enable students to identify, analyze, and suggest remedies for common defects in casting, welding, and forming processes, ensuring improved product quality and productivity.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Explain the principles, tools, and operations involved in casting processes, including pattern making, moulding, melting, and defect analysis.
CO2	Demonstrate understanding of various metal joining processes such as welding, soldering, and brazing, along with their equipment, applications, and quality inspection methods.
CO3	Describe the fundamentals of metal forming and plastic processing methods and analyze their applications in modern manufacturing industries.

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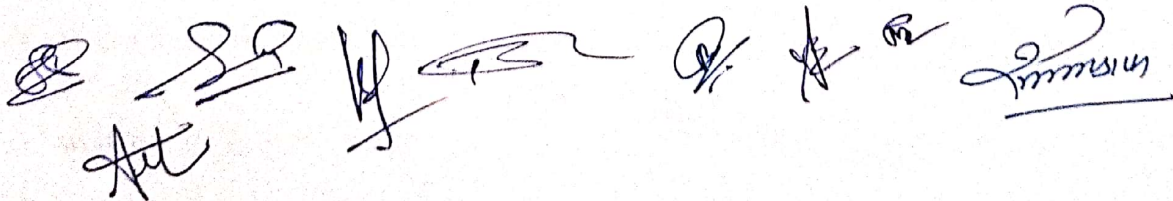
UNIT I: CASTING PROCESS	(8 HOURS) (10 MARKS)
<p>Pattern Making & Moulding: - Pattern making: Types, materials used, Pattern making allowances, color codes. Moulding sand: Composition, molding sand properties, Sand testing - Grain fineness, moisture content, clay content and permeability test. Core making: - Types, core material & its properties. Gating System & Casting Processes: - Elements of gating systems, riser. Melting furnaces - Types, Cupola, Casting defects - Types, Causes & remedies ,Types of casting : Investment Casting, Centrifugal Casting, Slush Casting, Die Casting, Shell moulding and CO2 moulding.</p>	
UNIT – II: JOINING PROCESS	(8 HOURS) (10 MARKS)
<p>Joining Process: Welding, brazing and Soldering Broad classification of welding processes, types and Principles. Electrodes, weldability of Metals, Welding equipment's. Fixtures, Arc Welding & Gas Welding Processes, TIG Welding, MIG Welding, Spot Welding, Plasma Arc welding and Electron Laser Beam welding. Inspection, Defects in various joints and their remedies.</p>	
UNIT – III: FORMING PROCESS FOR METALS AND PLASTIC PROCESSING	(8 HOURS) (10 MARKS)
<p>Forming Process : Hot working and cold working, Rolling, Forging, Extrusion, Drawing, Types & classification, Applications, Principles of all processes. Plastic Process: Introduction to Plastics, Properties & types, applications, Forming & Shaping of plastics –Extrusion, injection moulding, Blow moulding.</p>	

Textbooks

1. Workshop Practice, H. S. Bawa, Tata Mc-Graw Hill
2. Manufacturing Engineering & Technology, Kalpakjian, Pearson
3. Modern Materials and Manufacturing Process, R. Gregg Bruce, John E. Neely, Pearson Education
4. Workshop Technology (Volume I), Hajra Chaudhary, Media Promoters & Publishers
5. Workshop Technology (Vol. I & II), B. S. Raghuvanshi, Dhanpat Rai & Co.
6. Manufacturing technology (Vol. I), P. N. Rao, Tata Mc-Graw Hill
7. Manufacturing Science, Ghosh & Malik, East West Press.

Reference Book:

1. Workshop Technology, Vol I & II, WAJ Chapman, Elsevier Butterworth-Heinemann.
2. Manufacturing Processes, M. Begman.
3. Processes & Materials of Manufacturing, R. Lindberg, Allyn & Bacon.





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 SEMESTER IV
COURSE AS PER NEP

COURSE:- MANUFACTURING PROCESS LAB
COURSECODE: ME403P

Hours/Week	Credits	Duration of End Sem Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	1	--	25	25	50

Course Objectives:

1.	To develop practical understanding of basic manufacturing processes such as pattern making, moulding, casting, welding, and forming through hands-on experiments.
2.	To familiarize students with foundry tools, equipment, materials, and techniques used in mould and casting preparation, joining operations, and metal forming.
3.	To enable students to identify and analyze common defects in casting and welded joints, and suggest appropriate remedies for quality improvement.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Demonstrate the preparation of moulds and castings using appropriate foundry tools, materials, and techniques.
CO2	Perform basic joining operations such as arc, TIG, MIG, or resistance welding and identify defects in welded joints or cast components.
CO3	Explain and compare various casting, joining, and forming processes used in manufacturing industries.

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Course Content:

List of practical

Note: Any 08 experiments should be included in the Journal

1. Study of Different types of Patterns.
2. Study Of Different Moulding Techniques.
3. One Job – Sand Moulding
4. Study Of Cupola Furnace.
5. Study Of Different Casting Processes.
6. One Job – Casting
7. Study Of Joining Processes.
8. One Job – on Arc Welding/TIG/ MIG/ Resistance welding
9. Study Of Forming Processes.
10. Identification of casting defects their causes and remedies.

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DEPARTMENT OF MECHANICAL ENGINEERING
 SYLLABUS OF SECOND YEAR BACHELOR OF TECHNOLOGY,
 MULTIDISCIPLINARY MINOR COURSE AS PER NEP
 SEMESTER IV

COURSE: - INTRODUCTION TO ROBOTICS

COURSE CODE: ME404T

Hours/ Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	2	2 Hrs.	20	30	50

Course Objectives:

1.	To introduce the fundamental concepts of robotics, including automation, robot classifications, components, and their impact on society.
2.	To develop an understanding of various sensors and actuators used in robotic systems for effective sensing, control, and interaction with the environment.
3.	To explore diverse applications and types of robots, such as manipulators, mobile robots, humanoids, and autonomous systems, across sectors like manufacturing, healthcare, agriculture, and space.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Explain the basic concepts, history, classifications, components, and societal impact of robotics systems.
CO2	Classify various types of robots and Describe various actuators, sensors.
CO3	Identify and explain different applications of robots in industries and other real-life areas like healthcare, agriculture, and space.

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UNIT I: INTRODUCTION TO ROBOTICS	(8 HOURS) (10 MARKS)
Introduction To Robotics: Introduction to Robotics, laws of robot, history of robotics, basic components of robot, Specifications and classification of robots, human system and robotics, social impact, Robotics market and the future prospects, advantages and disadvantages of robots. Ethics and Safety in Robotics, Unmanned vehicles.	
UNIT – II: TYPES OF ROBOTS AND SENSORS	(8 HOURS) (10 MARKS)
Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, Humanoids, Robots, Autonomous robots, and Swarm robots. Introduction to sensors and actuator: Types of Actuators: Electric, Hydraulic, Pneumatic, Sensors: Position, Velocity, Force, Proximity, Vision.	
UNIT – III: ROBOTICS APPLICATIONS	(8 HOURS) (10 MARKS)
Robotics Applications: Material Handling: pick and place, palletizing and depalletizing, machining loading and unloading, welding & assembly, Medical, agricultural and space applications, ground, Ariel and underwater applications, robotic for computer integrated manufacturing.	

Textbooks

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009.
2. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012).
3. Ganesh S Hegde, "A textbook on Industrial Robotics", University science press, 3rd edition, 2017.

Reference Book:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill, 1987. <https://www.robots.com/applications>.



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DEPARTMENT OF MECHANICAL ENGINEERING
 SYLLABUS OF SECOND YEAR BACHELOR OF TECHNOLOGY,
 SEMESTER IV
COURSE AS PER NEP

COURSE:- OPEN ELECTIVE -2: AUTOMOBILE ENGINEERING

COURSE CODE: ME405AT

Hours/ Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	2	2 Hrs.	20	30	50

Course Objectives:

1.	To develop the understanding of various Automobile System and Function of its Components.
2.	To familiarize students with the power transmission, brakes, steering and suspension system used in automobile.

Course Outcomes:

After completion of the course, the student will be able to

CO1	To understand the concepts of automobile, its components and power train.
CO2	To understand the concept of clutches, Brakes and gear box of automobile.
CO3	To understand the concept of steering system and suspension system of automobile.

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SYLLABUS

UNIT I: INTRODUCTION OF AUTOMOBILES	(8HOURS) (10 MARKS)
Introduction: Classification of Automobiles , Major components, and their functions. Chassis Different vehicle layout and types of frames. Power train: Engine, Basic Components, Classification, Two Stroke, Four Stroke, Petrol Engine, Diesel Engine.	
UNIT – II: CLUTCH AND GEAR BOX	(8 HOURS) (10 MARKS)
Clutch: Necessity, requirements of a clutch system. Types of Clutches and its functions. Gear Box: Necessity of transmission, principle, types of transmission system, sliding mesh, constant mesh, Suspension systems: Function of spring and shock absorber.	
UNIT – III: TRANSMISSION AND STEERING SYSTEM	(8 HOURS) (10 MARKS)
Transmission system: Propeller shaft, universal joint. Differential – Need and types. Rear axles and Front axles. Brakes: Need & types, mechanical, hydraulic & pneumatic brakes. Steering systems: Principle of steering, steering geometry and wheel alignment, power steering.	

Textbooks:

1. Automobile Engineering Vol. I & II, Kirpal Singh, Standard Publishers.
2. Automobile Engineering, R.K.Rajput, Laxmi Publications.
3. Automobile Engineering R.B. Gupta, Satya Prakashan New Delhi
4. Course in Automobile Engineering, Sharma R. P, Dhanpat Rai and Sons.

Reference Book:

1. Automotive Engines, Srinivasan S., Tata McGraw Hill.
2. Automobile Engineering Vol. I, II & III, P. S. Gill, Kataria and Sons.
3. Automobile Engineering, K.K. Jain, R.B. Asthana, Tata McGraw Hill.



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DEPARTMENT OF MECHANICAL ENGINEERING
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 SEMESTER IV
COURSE AS PER NEP

COURSE:- OPEN ELECTIVE -2: PROJECT EVALUATION & MANAGEMENT

COURSE CODE: ME405BT

Hours/Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	2	2 Hrs.	20	30	50

Course Objectives:

1.	To develop an understanding of a structured approach for every unique project undertaken in the industrial context, emphasizing its need, concept, tools, and techniques of project management.
2.	To develop working knowledge of the technical and financial aspects of project management decisions and enhance skills in applying participatory methods to project management.
3.	To understand the project management life cycle and gain knowledge of various phases from project initiation through closure, including planning, budgeting, and control mechanisms.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Apply a structured approach to manage industrial projects using project management concepts, tools, and techniques.
CO2	Conduct project feasibility studies and prepare comprehensive project reports considering managerial, financial, and technical aspects.
CO3	Develop and manage project plans, including scheduling, budgeting, monitoring, and control using tools such as PERT and CPM.

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SYLLABUS

UNIT I: PROJECT CONCEPTS AND LIFE CYCLE	(8HOURS) (10 MARKS)
Definition and Characteristics of Project, Project Performance Parameters: Time, Cost, and Quality, Classification of Projects: Sector-based, Investment-based, Technology-based, Cause-based, and Need-based (Balancing, Modernization, Replacement, Expansion & Diversification), Project Life Cycle Phases: Concept/Initiation, Planning, Execution, Monitoring, and Closure, Project Identification Parameters and Sources of New Project Ideas, Governmental Framework for Project Identification, Incentives from State & Central Government, Import Substitution Projects	
UNIT – II: PROJECT FORMULATION AND FEASIBILITY ANALYSIS	(8 HOURS) (10 MARKS)
Project Conceptualization and Definition Phase, Project Formulation & Feasibility Studies: Pre-feasibility, Support/Functional Feasibility, Preparation of Project Feasibility Report & Specifications, Aspects of Project Feasibility: Managerial/Organizational: Promoter's background, Evaluation Criteria. Marketing/Commercial: Demand & Supply Analysis, Competition, Market Survey, Porter's Five Forces, Financial: Cost of Project, Means of Finance, Financial Projections (Profit & Loss Account, Balance Sheet, Funds Flow, Cash Flow Statement, Schedule of Fixed Assets, Schedule of Term Loans)	
UNIT – III: HAZARDOUS AND RADIOACTIVE WASTE MANAGEMENT	(8 HOURS) (10 MARKS)
Project Planning and Network Development, Project Representation: A-O-A and A-O-N Networks, Project Scheduling with Deterministic and Probabilistic Activity Times, Network Analysis & Duration Estimation (PERT/CPM), Work Breakdown Structure, Milestone Scheduling, Resource Leveling and Resource Smoothing, Project Crashing Techniques, Project Cost Estimation: Need, Nature, and Types of Estimates, Budgeting and Cost Control: Earned Value Management System (AC, PV, EV, Variances), Contract Management: Responsibility Matrix, Contract Types, and Risk Factors, Project Management Information System (PMIS) and Common Management Pitfalls	

Textbooks:

1. Narendra Singh, Project Management & Control, Himalaya Publishing House, Mumbai.
2. S. Choudhary, Project Management, Tata McGraw Hill.
3. Prasanna Chandra, Projects: Preparation, Appraisal, Budgeting & Implementation, Tata McGraw Hill, New Delhi.
4. Chas R. B., Aquilino N. J., Jacob F. R., Production and Operations Management: Manufacturing and Services, Tata McGraw Hill, New Delhi.

Reference Book:

1. Maylor H., Project Management, Pearson Education Asia, New Delhi.
2. Cleland D., Project Management, Tata McGraw Hill, New Delhi.



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DEPARTMENT OF MECHANICAL ENGINEERING
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 SEMESTER IV
COURSE AS PER NEP

COURSE:- OPEN ELECTIVE -2: WASTE MANAGEMENT

COURSE CODE: ME405CT

Hours/ Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	2	2 Hrs.	20	30	50

Course Objectives:

1.	To introduce the fundamentals of solid and hazardous waste, including their types, sources, characteristics, and environmental impacts.
2.	To provide knowledge on the methods of collection, segregation, processing, treatment, and disposal of municipal and hazardous wastes.
3.	To familiarize students with regulatory aspects and emerging technologies in solid, hazardous, and radioactive waste management for sustainable development.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Understand the sources, types, and impacts of solid and hazardous wastes on environmental health and society.
CO2	Analyze and apply appropriate methods for collection, segregation, processing, treatment, and disposal of various waste types.
CO3	Demonstrate awareness of legal, technological, and sustainable practices in managing municipal, hazardous, and radioactive wastes.

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SYLLABUS**UNIT I: SOLID WASTE AND MUNICIPAL WASTE MANAGEMENT
(8 HOURS) (10 MARKS)**

Definition and Types of Solid Wastes: Industrial, mining, agricultural, and domestic, Sources and Characteristics of Solid Waste, Problems and Environmental Health Impact of Solid Waste, Concepts of Waste Reduction, Recycling, and Reuse, Waste Characteristics, Generation, Collection, Transport, and Disposal, Handling and Segregation of Wastes at Source, Collection and Storage of Municipal Solid Waste, Analysis of Collection Systems, Transfer Stations – Labeling and Handling of Hazardous Wastes.

**UNIT – II: PROCESSING AND TREATMENT OF SOLID AND HAZARDOUS WASTE
(8 HOURS) (10 MARKS)**

Solid Waste Processing Technologies: Mechanical and thermal volume reduction, Biological and Chemical Techniques for Energy and Resource Recovery: Composting, overcomposting, termigradation, fermentation, Hazardous Waste Definition and Characteristics, Sources and Categories of Hazardous Waste, Sampling and Analysis of Hazardous Wastes: Analytical approach and proximate analysis, Regulatory Aspects of Municipal Solid Waste and Hazardous Waste.

**UNIT – III: HAZARDOUS AND RADIOACTIVE WASTE MANAGEMENT
(8 HOURS) (10 MARKS)**

Physical and Biological Routes of Transport of Hazardous Substances, Handling, Collection, Storage, and Transport of Hazardous Waste, TSDF Concept (Treatment, Storage, and Disposal Facility), Hazardous Waste Treatment Technologies: Physical, chemical, and thermal treatment, Radioactive Waste: Definition, Sources, Low-level and High-level wastes Radioactive Waste Management.

Textbooks:

1. Hazardous waste management Charles A. Wentz. Second edition 1995. Mc Graw Hill International.
2. Waste Management by Dr. Manish Moroliya & Dr. Akshay Anjekar. Notion Press.
3. Integrated solid waste management George Tchobanoglous, Hilary Theisen & Samuel A. Vigil.
4. Hazardous waste management by Prof. Anjaneyulu.
5. Biomedical waste management by Dr. Vishal Bathma.

Reference Book:

1. Environmental Sciences by Daniel B. Botkin and Edward A. Keller, Wileystudent, 6th edition- 2009.
2. Standard handbook of Hazardous waste treatment and disposal by HarryM. Freeman, Mc -Graw Hill 1997.



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DEPARTMENT OF MECHANICAL ENGINEERING
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SEMESTER IV
COURSE AS PER NEP

COURSE:- PYTHON PROGRAMMING LAB
COURSECODE: ME406P

Hours/Week	Credits	Duration of End Sem Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 4Hrs.	2	--	50	50	100

Course Objectives:

1.	To introduce students to the fundamentals of Python programming and develop logical thinking for engineering problem-solving.
2.	To enable students to implement Python-based computational techniques for mechanical engineering applications such as heat transfer, fluid mechanics, and design.
3.	To develop the ability to analyze, visualize, and interpret engineering data using Python libraries for effective decision-making and automation.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Apply Python programming constructs, such as data types, loops, functions, and data structures, to develop computational logic and problem-solving skills.
CO2	Utilize Python libraries like NumPy, Pandas, and Matplotlib for performing numerical analysis, data processing, and visualization in mechanical engineering applications.
CO3	Design and develop Python-based solutions for real-world mechanical engineering problems related to design, heat transfer, fluid mechanics, and kinematics.

Course Content:

List of practical

8 Hrs.

Note: Any 08 experiments should be included in the Journal

- To install and explore the Python programming environment (IDLE/Anaconda) and execute simple Python programs.
- To write Python programs using input/output operations, operators,

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- conditional statements, and loops for basic problem-solving.
3. Development of Python code for demonstration of array by Bubble sorting technique & Binary Searching.
 4. To import, clean, and analyze datasets using the Pandas library for applications in materials, thermal, or production engineering.
 5. Development of Python code dealing with basic Heat Transfer.
 6. Development of Python code to calculate best fit curve, sensitivity, and deviation in output of an instrument.
 7. Development of Python code to design knuckle joint.
 8. Development of Python code to solve basic fluid Mechanics Numerical.
 9. Development of Python code to solve basic kinematics of machine problems.
 10. To design a small Python-based application for solving a real-world mechanical problem (e.g., beam deflection calculator, gear ratio analyzer, or thermal efficiency estimator).





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DEPARTMENT OF MECHANICAL ENGINEERING
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SEMESTER IV
COURSE AS PER NEP

COURSE: - PROFESSIONAL COMMUNICATION

COURSE CODE: HUM407T

Hours/Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	2	2 Hrs.	20	30	50

Course Objectives:

1.	To develop students' proficiency in English communication through grammar, writing, and speaking exercises, while enhancing their professional and employability skills for effective performance in academic, workplace, and social settings.
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Course Outcomes:

After completion of the course, the student will be able to

CO1	Apply grammatical concepts such as tense, voice, and modal auxiliaries to construct grammatically correct and fluent spoken and written sentences.
CO2	Compose structured written documents and demonstrate effective oral communication through role plays, presentations, and professional writing formats.
CO3	Prepare job-related documents and exhibit confidence and professionalism during group discussions and interviews.

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SYLLABUS

UNIT I: GRAMMAR AND FOUNDATION FOR SPOKEN ENGLISH

(8 HOURS) (10 MARKS)

Grammar for Spoken English: Tense, Active and Passive Voice, Negative, Interrogative and Negative- interrogative sentences, use of modal auxiliary verbs, reinforcement exercises.

UNIT – II: WRITING AND SPEAKING SKILLS

(8 HOURS) (10 MARKS)

Paragraph writing and research paper writing, Role play exercises for speaking (at shop, restaurant, bank, airport, office, etc.), Public speaking and presentation techniques

Professional writing skills: Business letters, email, minutes of meeting, notices, circulars, memos, blog writing, virtual message drafting, one page report writing

UNIT – III: PROFESSIONAL COMMUNICATION AND JOB PLACEMENT SKILLS

(8 HOURS) (10 MARKS)

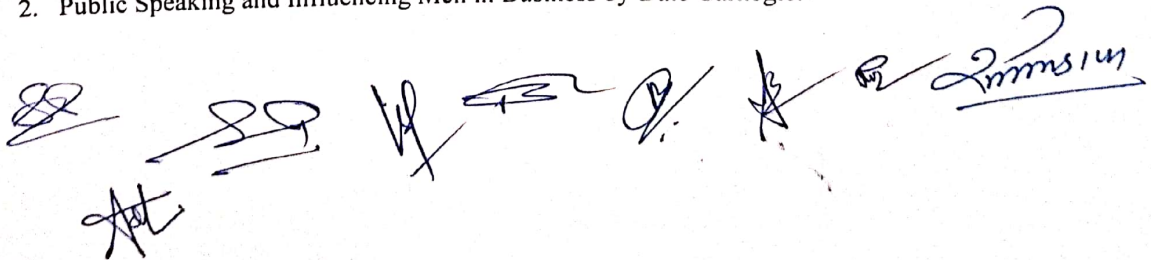
Job placement techniques: Job application letter, Resume writing, Group discussion, types of interviews, interview techniques, telephonic interview etiquettes

Textbooks:

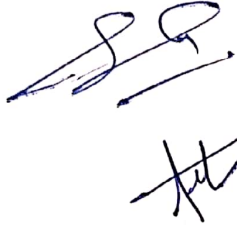
1. Communication Skills in English, Sanjay Kumar and Pushp Lata, Oxford University Press, India
2. Professional Communication Skills by Bhatia and Sheikh, S. Chand Publications
3. Communication Skills by Sanjeev Kumar and Pushpalata, OUP
4. Functional English for Technical Students by Dr. Pratibha Mahato and Dr. Dora Thompson, Himalaya Publishing House
5. Communication Skills by Lalita Bisen, Bhumika Agrawal, N.Thejo Kalyani, Himalaya Publishing House

Reference Book:

1. Technical Communication by Meenakshi Raman and Sangeeta Sharma, OUP.
2. Public Speaking and Influencing Men in Business by Dale Carnegie.



3. English Grammar and Composition – Wren & Martin, S. Chand Publications.
4. Developing Communication Skills – Krishna Mohan & Meera Banerji, Macmillan Publishers.
5. Business Communication – Lesikar, Pettit, and Flatley, McGraw Hill.
6. Soft Skills: Know Yourself and Know the World – K. Alex, S. Chand Publications.





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DEPARTMENT OF MECHANICAL ENGINEERING
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 SEMESTER IV
COURSE AS PER NEP

COURSE: - ENTREPRENEURSHIP AND STARTUPS

COURSE CODE: HUM408T

Hours/ Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	2	2 Hrs.	20	30	50

Course Objectives:

The course aims to

1.	Develop an understanding of the fundamentals of entrepreneurship and the role of entrepreneurs in economic development.
2.	Introduce students to the concepts of startups, ideation, and innovation processes that drive new ventures.
3.	Enable students to understand various sources of funding, government support, and real-world startup success factors.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Explain the concept, types, and functions of entrepreneurship and identify challenges faced by entrepreneurs, especially women, along with government support mechanisms.
CO2	Analyze different types of startups and apply ideation and design thinking techniques to generate innovative business ideas within a startup ecosystem.
CO3	Identify and evaluate various funding sources and strategies for startup growth by examining real-world entrepreneurial case studies.

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SYLLABUS**UNIT I: FUNDAMENTALS OF ENTREPRENEURSHIP AND ENTREPRENEURIAL DEVELOPMENT (8 HOURS) (10 MARKS)**

Concept of entrepreneurship, Characteristics and functions of an entrepreneur, Types of entrepreneurship, Women entrepreneurship in India, Problems and challenges faced by women entrepreneurs, Government support systems and policies for entrepreneurship development

UNIT - II: STARTUPS AND INNOVATION ECOSYSTEM (8 HOURS) (10 MARKS)

Concept and features of startups, Challenges and benefits of startups, Types of startups: Scalable startup, Small business startup, Lifestyle startup, Buyable startup, Social startup, Big business startup, Causes of startup failure, Startup ecosystem, Concept of ideation and ideation process, Idea incubation and design thinking approach, Ideation techniques: Brainstorming, Worst Idea, Mind Mapping, Sketching, Analogies, SCAMPER, Success factors for innovation and ideation.

UNIT - III: FUNDING, GROWTH, AND SUCCESS STORIES OF STARTUPS (8 HOURS) (10 MARKS)

Funding for startups: Private equity fund, Angel funding, Venture funding, Bootstrapping, Crowdfunding, Seed funding, Government grants, schemes, and subsidies for startups, Successful startup case studies, Growth and sustainability strategies for startups

Textbooks:

1. Entrepreneurship Development and Innovation, Vasant Desai, Himalaya Publishing House.
2. Entrepreneurship Development: Small Business Enterprises, Poornima M. Charantimath, Pearson Education.
3. Innovation and Entrepreneurship, Peter F. Drucker, Harper Business.
4. Startup and Venture Creation, P. Saravanavel and S. Sumathi, Himalaya Publishing House.

Reference Book:

1. Entrepreneurial Development By, S. S. Khanka S. Chand & Co. Ltd. New Delhi, 1999.
2. Small- Scale Industries and Entrepreneurship, By, Dr. Vasant Desai, Himalaya Publication.
3. The startup checklist by David. S. Rose, Wiley publications, 2016.
4. Trajectory: Start up: Ideation to Product/Market Fit by Dave Parker, Matt Holt Books.
5. Funding Your Startup By Dhruv Nath, Penguin Books India PVT Limited, 2020.

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DEPARTMENT OF MECHANICAL ENGINEERING
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 SEMESTER IV
COURSE AS PER NEP

COURSE: - DIGITAL AND TECHNOLOGICAL SOLUTION

COURSE CODE: HUM409T

Hours/ Week	Credits	Duration of End Sem. Exam	Continuous Evaluation	End Sem. Exam	Total Marks
TH- 2Hrs.	2	2 Hrs.	20	30	50

Course Objectives:

The course aims to

1.	Develop understanding of digital systems, ICT tools, and problem-solving fundamentals in computing.
2.	Equip students with knowledge of communication systems, computer networks, internet applications, and digital business tools.
3.	Familiarize students with Digital India initiatives, e-governance frameworks, and emerging digital financial tools for modern transactions.

Course Outcomes:

After completion of the course, the student will be able to

CO1	Describe the evolution of digital systems, explain ICT tools, and apply problem-solving techniques using algorithms and flowcharts.
CO2	Analyze the structure and function of communication systems, computer networks, and internet-based tools, and demonstrate understanding of e-commerce and digital marketing concepts.
CO3	Explain the key initiatives, services, and digital financial tools under Digital India and e-governance frameworks for societal and economic empowerment.

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SYLLABUS

UNIT I: ADVANCED INTERNET SKILLS	(8 HOURS) (10 MARKS)
Introduction & Evolution of Digital Systems. Role & Significance of Digital Technology. Information & Communication Technology & Tools. Computer System & its working, Software and its types. Operating Systems: Types and Functions. Problem Solving: Algorithms and Flowcharts.	
UNIT – II: COMMUNICATION SYSTEM	(8 HOURS) (10 MARKS)
Principles, Model & Transmission Media. Computer Networks & Internet: Concepts & Applications, WWW, Web Browsers, Search Engines, Messaging, Email, Social Networking. Computer Based Information System: Significance & Types. E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges.	
UNIT – III: DIGITAL INDIA AND E-GOVERNANCE	(8 HOURS) (10 MARKS)
Initiatives, Infrastructure, Services and Empowerment. Digital Financial Tools: Unified Payment Interface, Aadhar Enabled Payment System, USSD, Credit / Debit Cards, e-Wallets.	

Textbooks:

1. P. N. Thomas and A. Raghuramaraju, "Digital India: Understanding Information, Communication and Social Change," 2nd Edition, Sage Publications India Pvt. Ltd., 2017.
2. R. Thareja, "Computer Fundamentals and Programming in C," 2nd Edition, Oxford University Press, 2021.
3. R. P. Jain and S. K. Jain, "Introduction to Information Technology," 2nd Edition, Firewall Media, 2015.

Reference Book:

1. K. D. Tripathi, "Social Media: Concepts, Practices and Trends," 3rd Edition, PHI Learning Pvt. Ltd., 2020.
2. N. K. Venkateswaran, "Cyber Security and Digital Forensics: A Practical Approach," 2nd Edition, CRC Press, 2018.
3. S. Gandhi and R. Sharma, "Digital Privacy and Security," 3rd Edition, Springer Nature Singapore Pvt. Ltd., 2021.