Fourth Semester					
Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	HSMC	22CM4HS01T/ 22CM4HS02T	Humanities-1: Organizational Behavior/ Management-1: Engineering Economics & Costing	3-0-0	3
2	ESC	22ME4ES01T	Introduction to Python	3-0-0	3
3	PCC	22ME4PC01T	Fluid Mechanics	3-0-0	3
4	PCC	22ME4PC02T	Kinematics of Machines	3-0-0	3
5	PCC	22ME4PC03T	Manufacturing Science - I	3-0-0	3
6	PEC	22ME4PE01T/ 22ME4PE02T	Computer Integrated Manufacturing and Flexible Manufacturing System **(**CIM & FMS) Internal Combustion Engines	3-0-0	3
7	HSMC	22CM4HS03T	Universal Human Values-II/***	3-0-0	3
Total Credit (Theory)					**21**
Practical					
1	ESC	22ME4ES01L	Introduction to Python Laboratory	0-0-2	1
2	PCC	22ME4PC01L	Fluid Mechanics Laboratory	0-0-2	1
3	PCC	22ME4PC02L	Kinematics of Machines Laboratory	0-0-2	1
4	PCC	22ME4PC03L	Manufacturing Science - I Laboratory	0-0-2	1
Total Credit (Practical)					**4**
Total Semester Credit					**25**

Course Code:	Course Name:	L-T-P:	Credit:
22CM4HS01T	Organisational Behaviour	3- 0- 0	03

Course Objectives:

1. Developing an understanding of the behaviour of individuals and groups inside organizations by enhancing the skills in appreciating individual, interpersonal, and group processes for increase.
2. Developing effectiveness both within and outside of organizations is the goal of any organisation.
3. Through this course students will develop theoretical and practical insights.
4. The students will develop problem-solving capabilities for effectively managing the organizational processes.

Syllabus:

Module-I: Fundamentals of OB **[6 Hours]**

Introduction: Definition, nature and scope of OB (environmental and organizational context), Relationship between OB and the individual, Impact of IT, globalization and diversity on OB.

Module-II: Foundations of Individual Behaviour **[10 Hours]**

Personality: Meaning and definition, Determinants of personality, Personality traits, Personality and OB. Perception: Meaning and definition, Perceptual process, Importance of perception in OB. Motivation: Nature and importance, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory. Attitude: Definition, nature and dimensions, Attitude and OB. *Learning: Nature, learning and OB.*

Module-III*: Group Dynamics* of OB-I **[8 Hours]**

Communication: Types, interactive communication in organizations, barriers to communication, strategies to improve the follow of communication. Stress and Conflict: Meaning and types of stress, Meaning and types of conflict, Effect of stress on individuals, strategies to cope with stress and conflict.

Module-IV *Group Dynamics* of OB-II **[6 Hours]**

Power and Politics: Meaning and types of power empowerment. Groups Vs. Teams- Nature of groups, dynamics of informal groups, dysfunctions of groups and teams, teams in modern work place.

Module-V Foundations of Organizational Behaviour **[6 Hours]**

Organizational Culture: Culture and organizational effectiveness. Organizational Change: Types of change, reasons to change, resistance to change. *Organisational Structure and Development: Concepts and process.*

Course Outcomes:

1. Students will understand the essential of maintaining the inter-personal relationships in organisations.
2. Personality factors will be effectively used to understand the communication among groups.
3. The reasons for conflict will be known and prescriptive methods can be devised to enhance higher productivity in organisations.
4. Being an employee in an organisation the importance of organisational change and culture can be known to all.

Text Book:

1. Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.

Reference Books:

1. Understanding Organizational Behaviour, Parek, Oxford
2. Organizational Behaviour, Hitt, Miller, Colella, Wiley
3. Organizational Behaviour, K. Awathappa, HPH.
4. Organizational Behaviour, VSP Rao, Excel
5. Understanding Organizational Behaviour, Parek, Oxford

Course Code:	Course Name:	L-T-P:	Credit:
22CM4HS02T	Engineering Economics and Costing	3- 0- 0	03

Course Objectives: At the end of the course the engineering students will be able:

1. To prepare engineering students to understand the basic concepts of Engineering economics and their application.
2. To carry out numerically the effects of changes in demand and supply on price determinations of products and services.
3. To justify or reject alternative projects in the light of changing domestic and global scenario on the eve of technological innovations.
4. To analyse the macroeconomic environment and financial system of the country and its impact on business society and enterprise

Syllabus:

Module-I: **[10 Hours]**

Engineering Economics: Nature and Scope, Basic Problems of an Economy, Micro and Macro Economics; Demand: Meaning of demand, Determinants of demand, Demand function, Law of demand and its exceptions, Elasticity of demand and its measurement, (Simple numerical problems to be solved). Supply: Meaning of Supply, Determinants of Supply, Supply function, Law of Supply and its exception, Elasticity of Supply.

Module-II: **[7 Hours]**

Production: Factors of Production, Production Function; Laws of Returns: Law of Variable Proportions, Law of Returns to Scale, Cost and Revenue Concepts: Short Run Total Costs, Long Run Average Cost Curves, Total Revenue, Average Revenue and Marginal Revenue,

Module-III: **[6 Hours]**

Market Structures: Basic understanding of different Market Structures; Determination of Equilibrium Price under Perfect Market Competition and Monopoly. Margin of safety and Break Even Analysis: Linear Approach (Simple numerical problems to be solved).

Module-IV: **[10 Hours]**

Time Value of Money: Interest- Simple and Compound, Nominal and Effective Rate of Interest, Cash flow diagrams, Principles of Economic Equivalence, Evaluation of Engineering Projects:

Present, Future and Annual worth Method, Rate of Return Analysis; Cost-Benefit Analysis

Module-V: **[7 Hour]**

Inflation: Meaning of Inflation, Types, Causes and Measures to Control Inflation. National Income: Definition, Concepts of National Income and its measurement, Banking: Commercial Bank, Functions of Commercial Bank, Central Bank, Functions of Central Bank.

Course Outcomes:

1. Students will understand how to solve economic problems and the art of taking the right decision on scarce resources.
2. This will help to solve different microeconomic problems related to production, cost, and revenue maximization
3. Students will be understood different market structures and levels of competition and determine the price
4. This will help engineering students while evaluating and determining the cost of a project. This is also helpful in determining the value of money for future courses of action.
5. This will help to understand basic microeconomic concepts like inflation, national income, and money market.

Text Books:

1. Principles of Economics: Deviga Vengedasalam & Karun agaran Madhavan-Oxford Publication

Reference Books:

1. Engineering Economics and Costing: D. M. Methani & Suresh Chandra Das-Himalaya Publishing House
2. Engineering Economics and Costing: Sasmita Mishra-PH Learning Private Limited
3. R.Panneerselvam, ‘Engineering Economics’, PHI

4. Riggs,Bedworth and Randhwa, 'Engineering Economics', McGrow Hill Education India
5. Engineering Economics and Costing: Mahendra P. Agasty, Scitech Publications (INDIA) Pvt. Ltd.

Course Code: 22ME4ES01T	Course Name: Introduction to Python	L-T-P: 3-0-0	Credit: 3

Course Objective:

1. Understand and use different data types – list, tuple, dictionaries and set.
2. Work with operators and write simple programs.
3. Develop Python programs with conditionals and loops.
4. Define Python functions and working with files.

Module-I: **[8 Hours]**

Introduction to Python Programming Language: Introduction to Python Language and installation, overview on python interpreters, working with python, Numeric Data Types: int, float, Boolean, complex and string and its operations, Standard Data Types: List, tuples, set and Dictionaries, Data Type conversions, commenting in python.

Module-II: **[8 Hours]**

Variables and Operators: Understanding Python variables, Multiple variable declarations, Python basic statements, Python basic operators: Arithmetic operators, Assignment operators, Comparison operators, Logical operators, Identity operators, Membership operators, Bitwise operators, Precedence of operators, Expressions.

Module-III: **[8 Hours]**

Control Flow and Loops: Conditional (if), alternative (if-else), chained conditional (if- elif - else), Loops: For loop using ranges, string, Use of while loops in python, Loop manipulation using pass, continue and break

Module-IV: **[8 Hours]**

Functions: Defining Your Own Functions, Calling Functions, passing parameters and arguments, Python Function arguments: Keyword Arguments, Default Arguments, Variable length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. Powerful Lambda functions in python.

Module-V: **[8 Hours]**

I/O and Error Handling in Python: Introduction, Access Modes, Writing Data to a File, Reading Data from a File, Additional File Methods introduction to Errors and Exceptions, Handling IO Exceptions, Run Time Errors, Handling Multiple Exceptions. Introduction to Data Structures: What are Data structures, Types of Data structures, Data Analytics using Libraries: Pandas, Numpy, Matplotlib.

Course outcomes:

1. Acquire a fundamental understanding on basic concepts of python programming.
2. Understand data structure in Python like list, tuple, dictionaries and set.
3. Explore the understanding of function and OOPs concept in python.
4. Implement various python tools and libraries like Pandas, Numpy, Matplotlib

Text Books:

1. Python Programming: Using Problem Solving Approach, Reema Thareja , First Edition, Oxford University Press, 2017
2. Introduction to Computing and Problem Solving Using Python by E Balagurusamy, First Edition, McGraw Hill Education India Private Limited, 2017
3. Introducing Python: Modern Computing in Simple Packages, Bill Lubanovic , First Edition, O' Reilly Media, 2014
4. Core Python Programming, 2nd. Edition, by R. Nageswara Rao, Dreamtech Press (Wiley), 2019

Reference Books:

1. Programming Python: Powerful Object-Oriented Programming, Mark Lutz , 4th Edition, O' Reilly Media, 2011
2. Core Python Programming, Wesley J Chun , 2nd Edition, Prentice Hall, 2006 6. Python in Easy Steps, Mike McGrath , Easy Steps Limited, 2013
3. Introduction to Computing Using Python: An Application Development Focus, Ljubomir Perkovic, John Wiley & Sons, 2012

Digital Learning Resources:

Course Name	Programming, Data Structures and Algorithms using Python
Course Link	https://nptel.ac.in/courses/106106145
Course Instructor	Prof. Madhavan Mukund, Department of Computer Science and Engineering, Chennai Mathematical Institute

Course Code: 22ME4PC01T	Course Name: Fluid Mechanics	L-T-P: 3-0-0	Credit: 3

Course Objectives:

1. Compute pressure through manometer and design and develop marine systems with the usage of hydrostatic forces and buoyancy.
2. Differentiate velocity, acceleration, rotation and deformation etc. of fluid particles.
3. Establish Euler's theorem and deduce Bernoulli's equation for a ideal fluid and real fluids.
4. Examine and evaluate energy losses in fluid transmission trough pipes and open channel flow.

Syllabus:

Module-I:

[8 Hours]

Introduction: Scope of fluid mechanics and its development as a science, physical property of fluid, density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility andbulk modulus, fluid classification.

Fluid statics: Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer.

Module-II:

[8 Hours]

Hydrostatics: Hydrostatic force on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface. Buoyancy and flotation, Archimedes' principle, stability of immersed and floating bodies, determination of meta-centric height.

Module-III:

[8 Hours]

Fluid kinematics: introduction, description of fluid flow, classification of fluid flow. Reynold's number, acceleration of fluid particles, flow rate and continuity equation,

differential equation of continuity, mathematical definitions of irrotational and rotational motion. circulation, potential function, stream function, flow net

Module-IV:

[10 Hours]

Fluid dynamics: Introduction to N-S equation, Euler's equation along a streamline, energy equation, Bernoulli's equation, and its application to siphon, venturimeter, orifice meter, pitot tube.

Dimensional analysis: Introduction, Secondary or derived quantities, dimensional homogeneity, methods of dimensional analysis: Rayleigh's method and Buckingham's π theorem, model analysis, dimensionless numbers.

Module-V:

[8 Hours]

Flow in pipes and ducts: Loss due to friction, minor energy losses in pipes hydraulic gradient line (HGL), total energy line (TEL), power transmission in the fluid flow in pipes, fluid flow in pipes in series and parallel, flow through nozzles. Time required to empty the reservoir.

Open channel flow: Classification, Chezy's formula, Manning's formula, Flow through Orifice, Types of Orifices, Mouthpiece and its classification, Weirs and Notches, Discharge through weirs and notches

Course Outcomes:

5. Apply conservation laws to fluid flow problems in engineering applications.
6. Design and compute flow kinematics of the fluid.
7. Apply the concept of dynamics of flow.
8. Analyze the free surface and pipe flows for design hydraulic structures.

Text Books:

1. Y. A. Cengel and J. M. Cimbala, Fluid Mechanics , Tata McGraw-Hill, 3rd edition, 2017, New Delhi

2. CSP Ojha and P.N. Chandramouli, Fluid Mechanics and Machinery, Oxford University Press, 4th edition, 2010, New Delhi
3. S. K. Som and G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, McGraw Hill Education, 6th edition, 2017, New Delhi

Reference Books:

1. R. W. Fox, A. T. McDonald and P. J. Pritchard, Introduction to Fluid Mechanics, John Wiley, 8th edition, 2011, New Delhi
2. Piyush Kundu, Ira Cohen & David Dowling, Fluid Mechanics, Elsevier, 6th edition, 2016, Cambridge

Digital Learning Resources:

Course Name	Fluid Mechanics and Hydraulic Machines
Course Link	https://swayam.gov.in/nd1_noc19_me55/
Course Instructor	Dr. Sankar Kumar Som

Course Code:22ME4PC02T	Course Name: Kinematics of Machines	L-T-P:3-0-0	Credit: 03
Note: Each and every Module must practice with computer program like C, C++, Matlab, etc.			

Course Objective:

1. Describe the concept of machines, mechanisms and inversion
2. Analyze planar mechanism for displacement, velocity and acceleration both by graphical and analytic method
3. Analyze the function of different types of mechanical power transmitting elements.
4. Explain friction force in screw jack, clutches and mechanical brakes

Syllabus:

Module-I:

[8 Hours]

Kinematic fundamental: Basic Kinematic concepts and definitions, Degrees of freedom, Elementary Mechanism: Link, joint, Kinematic Pair, Classification of kinematic pairs, Kinematic chain and mechanism, Gruebler's criterion, Inversion of mechanism, Grashof criteria, Four bar linkage and their inversions, Single slider crank mechanism, Double slider crank mechanism and their inversion. Transmission angle and toggle position, Mechanical advantage.

Module-II:

[8 Hours]

Kinematic Analysis: Graphical analysis of position, velocity and acceleration of four bar and Slider crank mechanisms. Instantaneous center method, Aronhold-Kennedy Theorem, Rubbing velocity at a Pin-joint. Coriolis component of acceleration.

Module-III:

[8 Hours]

Toothed gearing: Gear Terminology and definitions, Law of gearing, interference, length of path, Arc of contact.

Gear trains: Simple Train, Compound train, Reverted train, Epicyclic train and their applications.

Module-IV:

[10 Hours]

Flexible Mechanical Elements: Belt, rope and chain drives, initial tension, effect of centrifugal tension on power transmission, maximum power transmission capacity, belt creep and slip.

Combined Static and Inertia Force Analysis: Inertia forces analysis, velocity and acceleration of slider crank mechanism by analytical method, engine force analysis - piston effort, force acting along the connecting rod, crank effort.

Module-V:

[8 Hours]

Friction Effects: Screw jack, friction between pivot and collars, single, multi-plate and cone clutches, anti friction bearing, film friction, friction circle, friction axis.

Brakes: Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, braking of a vehicle.

Course Outcomes: Students are able to -

1. Apply kinematic principles to analyze the motion and behavior of mechanical systems
2. Analyze velocity and acceleration of various mechanisms.
3. Understand the importance of various gears and gear trains.
4. Analyze the mechanical power transmitting devices and inertia forces of various four bar mechanisms and friction force in screw jack, clutches and mechanical brakes.

Suggested Books:

1. Theory of Machines by Thomas Bevan, CBS Publications
2. Kinematics and Dynamics of Machinery by Charles E. Wilson and J.Peter Saddler, Pearson Education
3. Mechanism and Machine Theory by J.S.Rao and R.V.Dukipatti, New Age International.

4. Theory of Mechanisms and Machines by A. Ghosh & A. K. Mallick, East West Press.

Course Code: 22ME4PC03T	Course Name: Manufacturing Science - I	L-T-P: 3-0-0	Credit: 03

Course Objectives:

1. To understand basic manufacturing processes like casting, welding
2. To learn various aspects of different manufacturing techniques such as various casting methods, welding methods and metal forming methods
3. To decide which manufacturing technology can be implemented for a specific product
4. To learn about metal forming processes such as rolling, sheet metal working, extrusion and wire drawing processes

Syllabus:

Module-I:

[10 Hours]

Foundry: Types of patterns, pattern materials and pattern allowances:

Molding Materials: sand molding, metal molding, investment molding, shell molding, composition of molding sand, silica sand, zircon sand, binders, additives, binders - clay, binders for CO2 sand, binder for shell molding, binders for core sand, Properties of molding sand and sand testing;

Melting furnaces: cupola, resistance furnace, induction and arc furnace; Solidification of castings, degasification and inoculation of metals, casting methods like continuous casting, centrifugal casting, die casting, casting defects.

Module-II:

[8 Hours]

Welding and cutting: Introduction to gas welding, cutting, arc welding and equipment's. TIG and MIG welding, resistance welding and thermit welding; modern welding methods like plasma arc, laser beam, electron beam, ultrasonic, explosive and friction welding; edge preparation in butt welding, brazing and soldering, welding defects.

Testing: Destructive and non- destructive testing of castings and welding.

Module-III:

[8 Hours] Plastic deformation of metals: Variables in metal forming and their optimization, dependence of stress strain diagram on Strain rate and temperature, hot and cold working of metals, classification of metal forming processes

Forging: Smith forging, drop and press forging, M/c forging, forging defects

Powder Metallurgy: Brief introduction to powder metallurgy process

Module-IV:

[8 Hours]

Extrusions: Direct, indirect, impact and hydrostatic extrusion and their applications, extrusion of tubes

Sheet metal working: Bending, forming and shallow drawing, shearing.

Module-V:

[8 Hours]

Drawing: Wire drawing methods and variables in wire-drawing, optimum dies shape for wire drawing

Rolling: Pressure and forces in rolling, types of rolling mills, rolling defects

Course Outcomes:

On completion of the course, students will be able to

1. Recognize the different types of casting processes.
2. Select suitable manufacturing process for typical components.
3. Describe the various welding processes.
4. Explain the concept of forging, rolling process and drawing.

Text Books:

1. P. N. Rao, Manufacturing technology, Volume 1, Tata McGraw Hill publication, 4th edition, 2013, New Delhi
2. R. A. Little, Welding Technology , Tata McGraw Hill publication, 2017, New Delhi

Reference Books:

1. A. Ghosh and A. K. Malick, Manufacturing Science, EWP, 2nd edition, 2010, New Delhi
2. P. C. Sharma, A Text Books of Production Engineering, S. Chand Publishing, 11th edition, 2019, New Delhi

Digital Learning Resources:

Course Name	Manufacturing Science - I
Course Link	https://nptel.ac.in/courses/112/107/112107219/
Course Instructor	Prof. D. K. Dwivedi

Course Code: 22ME4PE01T	Course Name: Computer Integrated Manufacturing and Flexible Manufacturing System (CIM & FMS)	L-T-P: 3-0-0	Credit: 03

Course Objectives:

1. To learn the application of computers in manufacturing sectors.
2. To learn about NC part programming and robot programming
3. To learn application of computer in quality inspection, process planning, design.
4. To design CIM systems to fulfill the requirements of the industry

Syllabus:

Module-I:

[8 Hours]

Fundamentals of manufacturing and automation: Production systems, automation principles and its strategies, manufacturing industries, types of production function in manufacturing, automation principles and strategies, elements of automated system, automation functions and level of automation.

Module-II:

[8 Hours]

Production planning: Product/production relationship, production concept and mathematical models for production rate, capacity, utilization and availability, cost-benefit analysis

Computer integrated manufacturing: Basics of product design, CAD/CAM, Concurrent engineering, CAPP and CIM.

Module-III:

[10 Hours]

Industrial robotics: Robot anatomy, control systems, end effectors, sensors and actuators; fundamentals of NC technology, CNC, DNC, NC part programming; robotic programming, robotic languages, work cell control, robot cleft design, types of robot application, processing operations,

Programmable logic controllers: Parts of PLC, operation and application of PLC, fundamentals of Net workings, material handling and automated storage and retrieval systems, automatic data capture, identification methods, bar code and other technologies.

Module-IV:

[6 Hours] Introduction to manufacturing systems: Group technology and cellular manufacturing, part families, part classification and coding, production flow analysis, machine cell design, applications and benefits of group technology.

Module-V:

[8 Hours]

Flexible manufacturing system: Basics of FMS, components of FMS, FMS planning and implementation, flexibility, quantitative analysis of flexibility, application and benefits of FMS.

Computer aided quality control: Objectives of CAQC, QC and CIM, CMM and flexible inspection systems.

Course Outcomes: The students will be able to

1. apply computer to manufacture industrial components.
2. understand the elements of an automated manufacturing environment.
3. make NC part programming and robot programming.
4. explain the concept of group technology and flexible manufacturing System

Suggested Books:

1. M. P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, Pearson Publication, 4th edition, 2016, Chennai
2. P. Radhakrishnan, S. Subramanyam and V. Raju, CAD/CAM/CIM, New Age International, 4th edition, 2018, New Delhi
3. J. Talavage and R. G. Hannam, Flexible Manufacturing Systems in Practice, Marcell Decker, US, 1987

Digital Learning Resources:

Course Name	Computer Integrated Manufacturing and Flexible Manufacturing System (CIM & FMS)
Course Link	https://nptel.ac.in/courses/112/104/112104289/
Course Instructor	Prof. Janakarajan Ramkumar and Prof. Amandeep Singh

Course Code: 22ME4PE02T	**Course Name: Internal Combustion Engines**	**L-T-P: 3-0-0**	**Credit: 03**

Course Objectives:

1. To understand the operating characteristics and terms used in engines.
2. To study the fuel induction and combustion process in engines.
3. To accustom with the environmental effect and fuel economy challenges facing by the engines.
4. To impart knowledge about various modern developments in engines.

Syllabus:

Module-I:

[10 Hours]

Introduction: Classification, engine nomenclature, engine operating and performance parameters, valve timing diagram of SI (spark ignition) and CI (compression ignition) engines, comparison of SI and CI engine.

Thermodynamic Analysis of cycles: Significance actual cycles of internal combustion engines. comparison with air standard cycles. analysis actual cycles (effect of exhaust gas dilution. Time loss factor, heat loss factor, exhaust blow down, loss due to gas exchange processes, volumetric efficiency, loss due to rubbing friction).

Module-II:

[8 Hours]

Fuel Induction Techniques in IC engines: Fuel induction techniques in SI and CI engines, Mixture Requirements at Different Loads and Speeds.

Carburetion: Factors affecting carburetion, principle of carburetion, simple carburetor and its drawbacks, calculation of the air–fuel ratio, Solex, S. U. and Carter carburetor.

Fuel Injection: Functional requirements of an injection system, classification of injection systems, fuel injector, nozzle, injection in SI engine, electronic injection systems, injection timing.

Module-III:

[8 Hours]

Ignition: Energy requirement for ignition, requirements of an ignition system, conventional ignition systems, modern ignition systems (TCI and CDI), firing order, Ignition timing, Spark advance mechanism.

Combustion: Stages of combustion in SI and CI engines, effects of engine variables on flame propagation and ignition delay, abnormal combustion, preignition and detonation, theory of detonation, effect of engine variables on detonation, control of detonation, diesel knock and methods to control diesel knock.

Module-IV:

[6 Hours]

Super Charging and Scavenging: Thermodynamic cycles of supercharging, effect of supercharging, efficiency of supercharged engines, methods of super charging, turbocharging, superchargers, supercharging and scavenging of 2- stroke engines.

Engine Emission and control: Mechanism of pollutant formation and its harmful effects, methods of measuring pollutants and control of engine emission.

Module-V:

[8 Hours]

Fuels: Fuels for SI and CI engine, fuel additives, properties, potential and advantages of alternative liquid and gaseous fuels for SI and CI engines (biofuels, LPG and CNG).

Cooling and Lubricating Systems: Air cooling and water-cooling systems, effect of cooling on power output and efficiency, properties of lubricants and different types of lubricating system;

Modern developments in IC Engines: EGR (Exhaust Gas Recirculation), MPFI (Multi-Point Fuel Injection), CRDI (Common Rail Direct Injection), GDI (Gasoline direct injection),

HCCI (Homogeneous-Charge Compression Ignition), dual fuel engine, Lean burn engine, Stratified engine (basic principles).

Course Outcomes:

1. Describe the operating characteristics of internal combustion engines.
2. Demonstrate the fuel induction in the engine.
3. Demonstrate the ignition and combustion phenomena in the engine.
4. Explain the heat transfer mechanism, pollutant formation and basic principles of various modern developments in the engine.

Text Books:

1. M. L. Mathur & R. P. Sharma, A Course on Internal Combustion Engines, Dhanpat Rai Publication, 8th edition, 1996, New Delhi
2. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill publication, 4th edition, 2017, New Delhi

Reference Books:

1. V. M. Domkundwar, A course in Internal Combustion Engines, Dhanpat Rai & Co publication, 1st edition 1999, New Delhi

Digital Learning Resources:

Course Name	Internal Combustion Engines & Gas Turbines
Course Link	https://nptel.ac.in/courses/112/103/112103262/
Course Instructor	Prof. Pranab K. Mondal, Prof. Vinayak N. Kulkarni

Course Code:	Course Name:	L-T-P: 0-	Credit:
22ME4ES01L	**Introduction to Python Laboratory**	**0-2**	**1**

Course Objectives: The course will enable students to:

1. Learn and understand Python programming basics and control statements.
2. Illustrate the applications of string handling and regular expressions in building Python programs using functions.
3. Discover the use of supported data structures like lists, dictionaries and tuple in Python.
4. Understand about Functions, Modules and Regular Expressions in Python Programming and different libraries.

Syllabus:

List of Experiments:

1. Demonstrate about Basics of Python Programming.
2. Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)
3. Demonstrate the working of following functions in Python. (type(), range())
4. Demonstrate the Operators in Python with suitable examples.
5. Write Python programs to demonstrate print().
6. Demonstrate the Conditional statements in Python with suitable examples.
7. Demonstrate the Iterative statements in Python with suitable examples.
8. Demonstrate the control transfer statements in Python with suitable examples (break, continue and pass)
9. Write Python programs to print different Patterns.
10. Write a Python program to demonstrate various ways of accessing the string.
    a) Indexing (positive and negative)
    b) Slice operation

11. Demonstrate the functions/methods which operate on strings in Python with suitable examples.
12. Demonstrate the functions/methods which operate on lists in Python with suitable examples.
13. Demonstrate the functions/methods which operate on tuple in Python with suitable examples.
14. Demonstrate the functions/methods which operate on set in Python with suitable examples.
15. Demonstrate the functions/methods which operate on dictionary in Python with suitable examples.
16. Demonstrate the kinds of Parameters used while writing functions in Python.
17. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib)

Course Outcomes:

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

2. Acquire a fundamental understanding of the basics of Python Programming.
3. Understand and implement the Data Structures in Python: List, Tuple, Set and Dictionary
4. Illustrate the concepts of strings and regular expressions in Python.
5. Implement various Python tools and Libraries like Panda, Numpy, SciKit, matplotlib etc.

Course Code: 22ME4PC01L	Course Name: Fluid Mechanics Laboratory	L-T-P: 0-0-2	Credit: 1

Course Objectives:

The students able to

2. know about basic concept of buoyancy force with the flow device.
3. impart training on flow measuring devices such as orifice, venturi.
4. provide practice in estimating friction losses.
5. get basic information about fluid flow and its mechanism

Syllabus:

List of the Experiments:

1. Determination of Meta-centric Height and application to stability of floating bodies.
2. Calibration of a venturimeter.
3. Calibration of an orifice.
4. Calibration of orifice meter.
5. Calibration of V-notch.
6. Flow through rectangular notch.
7. Experiments on impact of Jets
8. Classification of flows using Reynolds apparatus
9. Verifications of Stokes Law
10. Determination of Manning's roughness coefficient of a channel.
11. Experiments on Flow through pipes

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

6. Determine Stability of submerged and floating bodies.
7. Characterize laminar and turbulent flows.
8. Calibrate flow discharge measuring device used in pipes in channels and tanks.
9. Compute coefficients of orifice.

Course Code: 22ME4PC02L	Course Name: Kinematics of Machines Lab	L-T-P: 0-0-2	Credit: 01

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Course Objectives:

The students will able to

5. Understand the motion resulting from a specified set of linkages and to synthesize the mechanism.
6. Understand the effect of screw jacks, bearings and clutch.
7. Understand the basic concepts of toothed gearing and kinematics of gear trains.
8. Determine friction in brakes and dynamometer.

Syllabus:

List of Experiments:

6. Radius of gyration of compound pendulum
7. Radius of gyration of connecting rod
8. TRI –FILAR / BI-FILAR System
9. Experiment on Screw Jack
10. Experiment on Journal Bearing Apparatus
11. Experiment/Study on clutches
12. Experiment on Epicyclic Gear Train
13. Experiments on Simple/Compound/Reverted Gear trains
14. Experiment on Dynamometer
15. Experiment on Brake
16. Experiment on Coriolis component of acceleration

Course Outcomes:

At the end of the course, the student will be able to:

6. Analyze the velocity and acceleration of links of different mechanisms.
7. Evaluate the effect of friction in screw jacks, bearings and clutch.
8. Design and develop a gear train as per power transmission & gear terminologies and can calculate velocity of gears.
9. Analyze friction in breaks and dynamometer.

Course Code:	Course Name:	L-T-P: 0-0-	Credit:
22ME4PC03L	Manufacturing Science - I Lab	2	01

Course Objectives:

1. To determine the grain size of the sand, clay content in the sand sample, permeability of the test sample and to find out tensile, compressive and shear strength of the moulding sand
2. To familiar with foundry practices.
3. To determine the strength of brazed and soldered joint
4. To familiar with different types rolling mills and extrusion processes

Syllabus:

List of Experiments: any five

1. Determination of grain size, clay content, permeability and green compressive strength of molding sand. (2 to 3 experiments)
2. Foundry Practices: preparation of sand mold.
3. Preparation of a wood pattern.
4. Determination of strength of brazed and solders joints
5. Practice and preparation of job in sheet metal using processes like forming and deep drawing.
6. Demonstration of different rolling mills
7. Demonstration of extrusion processes

Course Outcomes: Students are able to:

1. determine the grain size of the sand, clay content in the sand sample, permeability of the test sample and are able to determine the tensile, compressive and shear strength of the molding sand.
2. know the foundry practices and are able to make patterns
3. determine strength of brazed and soldered joint

4. get familiar with different types of rolling mills and extrusion process.