LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-21]
(w.e.f. Academic Year 2022-23)
B.E. III-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/ Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	U21MA302	BSC	Mathematics-III (PDE & PS)	3	1	-	4	40	60	3	4
2	U21ME301	ESC	Engineering Mechanics	3	-	-	3	40	60	3	3
3	U21EN301	HSMC	English for Technical Communication	2	-	-	2	40	60	3	2
4	U21ME302	PCC	Manufacturing Processes	3	-	-	3	40	60	3	3
5	U21ME303	PCC	Thermodynamics	3	-	-	3	40	60	3	3
Practical / Laboratory Course											
6	U21EN3L1	HSMC	Advanced Communication Skills Lab	-	-	3	3	25	50	3	1.5
7	U21ME3L1	PCC	Manufacturing Processes Lab	-	-	3	3	25	50	3	1.5
8	U21ME3L2	PCC	Machine Drawing and Modelling Lab	-	-	3	3	25	50	3	1.5
Skill Development Course											
9	U21CS3L1	ESC	Programming Language-I	-	-	3	3	25	50	3	1.5
Bridge Course*											
10	U21CS3L2	ESC	C Programming Lab	-	-	2	2	50	-	-	-
11	U21EN3L2	HMSC	Effective Communication Skills Lab	-	-	2	2	50	-	-	-
Total				**14**	**1**	**12 (*16)**	**27 (*31)**	**300 (*400)**	**500**	**27**	**21**

*** Bridge Course for Lateral Entry Students only.**

L: Lecture (Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical **D**: Drawing (Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation
SEE: Semester End Examination
BSC: Basic Science Course
ESC: Engineering Science Course
MA: Mathematics
EN: English
PCC: Professional Core Courses
ME: Mechanical Engineering
CS: Computer Science
HSMC: Humanities & Social Sciences Including Management Courses

Note:

1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core / Elective
U21MA302	Mathematics – III (PDE & PS) (Common to Civil and Mechanical Engineering)						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Basic Mathematics	L	T	D	P			
	3	1	-	-	40	60	4

Course Objectives:

The objective of the course is to:

1. Introduce PDE and solution of first order PDE.
2. Introduce the solution methodologies for second order Partial Differential Equations with applications in engineering.
3. Provide an overview of probability and statistics to engineers.
4. Obtain the concepts of curve fitting, correlation and test of significance.
5. Acquire the knowledge of Test of Hypothesis pertaining to mean and variance, chi-square for goodness of fit.

Course Outcomes:

After completing the course, the student will be able to:

1. Solve field problems in engineering involving first order PDEs.
2. Solve field problems in engineering involving higher order PDEs.
3. Apply the concepts of probability, distributions and it moments, kurtosis and skewness.
4. Determine the coefficient of correlation, regression and obtain the knowledge of sampling theory with context to test of hypothesis.
5. Analyze and check the validity of statement using testing of hypothesis for various parameters and goodness of fit.

UNIT-I

Formation of Partial Differential Equations, First order partial differential equations, solutions of first order linear Partial Differentiation Equations, Lagrange's equation, Non-linear First Order equations, Charpit's method.

UNIT-II

Second-order linear equations and their classification, Method of separation of variables, vibration of stretched string wave equation, one dimensional heat equation, two-dimensional heat equation, solution of Laplace's equation.

UNIT-III

Probability distributions: Poisson, Uniform and Normal distributions, Mean, variance, Moment generating function and evaluation of statistical parameters for these distributions, Moments, Skewness and Kurtosis.

UNIT-IV

Curve fitting by the method of least squares: Fitting of straight lines, second degree Parabolas and more general curves, Correlation, regression and Rank correlation. Test of Significance: Large sample test for single proportion, difference of proportions, single mean, Difference of means and difference of standard deviations.

UNIT-V

Test for single mean, difference of means and correlation coefficients, test for ratio of Variances, Chi-square test for goodness of fit and independence of attributes.

Suggested Reading:

1. R.K.Jain & Iyengar, "Advanced Engineering Mathematics", Narosa Publications.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
3. P.Sivaramakrishna Das & C.Vijaya Kumar, "Engineering Mathematics" , Pearson India Education Services Pvt. Ltd.
4. N.P. Bali & M. Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications,2010.
5. S.C.Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics" , S.Chand Pub.
6. P. G. Hoel, S. C. Port & C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.

Course Code	Course Title					Core / Elective
U21ME301	**Engineering Mechanics**					**Core**
Prerequisite	Contact Hours per Week			CIE	SEE	Credits
	L	T	P/D			
Engineering Physics	**3**	**-**	-	40	60	**3**

Course Objectives:

The objective of the course is to:

1. The resolution of forces, equilibrium and compatibility conditions of static loads.
2. Friction and various frames by method of joints and sections.
3. Understand distributed force systems, centroid/ center of gravity and method of finding centroids of composite figures and bodies.
4. Draw displacement diagram for followers with various types of motions.

Course Outcomes:

After completing the course, the student will be able to:

1. Determine the equilibrium of a particle in space using principle of laws of mechanics.
2. Analyze the trusses and frames and compute the friction.
3. Compute the equilibrium of rigid bodies in two dimensions and in three dimensions.
4. Find the centroid and moment of inertia of simple and composite areas.
5. Solve the problems of simple system with sliding friction and calculate linear and angular acceleration of moving body in general plane motion.

UNIT-I

Introduction to Engineering Mechanics: Basic Concept of applied mechanics, statics, Dynamics, space, time, mass, particle, flexible body, Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant-Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II

Analysis of Perfect Frames: (Analytical Method) Types of Frames, Assumptions for forces in members of perfect frame, Method of joints and Method of sections for Cantilever Trusses, simply supported Trusses. **Friction**: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, Ladder Friction.

UNIT-III

Centroid: Centroid of simple areas (from basic principles), Centroid of Composite areas. **Area Moment of Inertia**: Definition, Moment of inertia of simple areas (from basic principles), Polar Moment of Inertia, Transfer formula, Moment of Inertia of Composite areas, Mass moment of inertia.

UNIT-IV

Kinematics: Introduction, Motion of particle, Rectilinear and Curvilinear motions, Velocity and Acceleration, Types of Rigid body, Angular motion, Fixed axis rotation. **Kinetics:** Introduction, fundamental equation of kinetics for a particle, D' Alembert's principle for particle motion, connected system and Fixed Axis Rotation.

UNIT-V

Work - Energy Method: Introduction, Equations for Translation, Work-Energy Applications to Particle Motion, Connected System and Fixed Axis Rotation. **Impulse Momentum Method**: Linear impulse momentum, law of conservation of momentum, coefficient of restitution, Elastic impact.

Suggested Reading:

1. Ferdinand L. Singer, ―Engineering Mechanics", Collins, Singapore, 1975.
2. Reddy Vijay Kumar K. and K. Suresh Kumar, ―" Singers Engineering Mechanics", 2010.
3. S.S Bhavakatti, ―Engineering Mechanics", New age international publishers.
4. Rajeshakharam, S. and Sankarasubrahmanyam, ―G.,Mechanics", Vikas Publications, 2002.
5. Junarkar, S.B. and H.J. Shah., ―Applied Mechanics", Publishers, 2001.

Course code	Course Title						Core/Elective
U21EN301	**English for Technical Communication**						-
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
Basic English	L	T	D	P			
	2	-	-	-	40	60	2

Course Objectives:

The objective of the course is to:

1. Understand the significance of Technical Writing.
2. Various aspects of professional communication.
3. Different types of business correspondence.
4. Various styles of technical report writing.
5. Designing, creating and developing technical manual.
6. Familiarize with the technical features of information transfer.

Course Outcomes:

After completing the course, the student will be able to:

1. Acquire and apply technical communication professionally.
2. Correspond technically through various methods and style of technical writing.
3. Apply different types of business correspondence in various situations.
4. Gain and apply different technical writing skills of report writing.
5. Obtain efficient skills in creating and designing technical manuals.

UNIT-I

Definition and Features of Technical communication: Definition, Types and Process of Communication, Definition and features of technical communication (precision, relevance, format, style, use of visual aids),Difference between general writing and technical writing, Types of technical communication.

UNIT-II

Technical Writing-I (Official correspondence): Emails, Business letters (all types), Business proposals, Preparation of Minute of Meeting.

UNIT-III

Technical writing-II (Reports): Definition, Importance, Types of Report - Memo, Letter & Manuscript, Feasibility report, Project report, Progress report, Evaluation report.

UNIT-IV

Technical writing-III (Manuals): Types of manuals, User manual, Product manual, Operation manual.

UNIT-V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested Reading:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). Technical Communication:Principles and Practice (3rd ed.). New Delhi.
2. Rizvi, Ashraf, M. (2017).Effective Technical Communication (2nd ed.).Tata McGrawHill Education. New Delhi.
3. Sharma, R. C., & Mohan, Krishna. (2017). Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication (4th ed.). TataMcGraw Hill Education. New Delhi.
4. Tyagi, Kavita & Misra, Padma. (2011). Advanced Technical Communication. NewDelhi, PHI Learning.
5. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.

Course Code	Course Title						Core/Elective
U21ME302	**Manufacturing Processes**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Basic Physics	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

The objective of the course is to:

1. Make the students aware of different manufacturing processes like casting, metal forming, forging methods, joining processes.
2. Know the advantages and limitations of each process.
3. Select the optimal process to produce a product.
4. Know the basic principle of advanced forming processes.

Course Outcomes:

After completing this course, the student will be able to:

1. Describe the concepts of Foundry Technologies consisting of producing casting by pattern making, mould making, Riser, Gating designing.
2. Discuss the importance of special casting processes, categorize various casting defects and describe the processing of plastics and powder metallurgy concepts.
3. Classify and differentiate various Arc welding, Gas welding discuss their advantages, applications and limitations & Understand the arc, gas welding processes.
4. Differentiate &understands the various solid state and resistance welding processes. Discuss their applications, and identify various welding defects.
5. Describe various forming processes, sheet metal operations and discuss the importance of forming processes.

UNIT-I

Casting: Steps involved in making a casting – Advantage of casting and its applications;, Casting terms Patterns ,Types, Materials used for patterns, pattern allowances, core, Moulding sands, Properties of moulding sands. Types of moulding machines, Directional solidification, use of chaplets, chills, Riser – Function, Design of gating systems.

UNIT-II

Special Casting Processes: Shell moulding, CO_2 moulding, die casting, centrifugal casting, investment or lost wax process; Casting defects, causes and remedies, Inspection and testing of castings. Processing of plastics- extrusion, injection moulding, blow moulding and thermo forming. Introduction to Powder Metallurgy- Process, Production of powders, blending, mixing, compaction techniques and finishing operations employed in powder metallurgy processes.

UNIT-III

Welding processes: Introduction, Classification of welding processes, gas welding equipment and techniques, types of flames. arc welding.- SMAW, SAW, GMAW, GTAW, PAW, Atomic hydrogen welding, principle of Electro slag welding, Gas cutting, Brazing and Soldering.

UNIT-IV

Solid State Welding Process: Forge Welding, Friction Welding, Friction Stir Welding, and Explosive Welding. Resistance welding processes - Spot welding, Seam welding, Projection welding, weldability, welding defects – causes and remedies.

UNIT-V

Forming Processes: Hot extrusion and cold extrusion - Forward extrusion and backward extrusion –description of Forging, Rolling, Drawing operations. Sheet Metal Operations: Blanking, Piercing, Bending, Deep drawing, Spinning. Advance Forming Processes- High energy rate forming processes such as Explosive forming, Electro- magnetic forming and Electro-hydraulic forming; Rubber pad forming.

Suggested Readings:

1. P.N. Rao, ―Manufacturing Technology,‖ Vol. 1, Tata McGraw Hill Publ., 3nd Ed., 2011.
2. Amitabh Ghosh & Mallick, ―Manufacturing Science‖, Assoc. East west Press Pvt. Ltd. 4th Ed., 2011.
3. Hajra Choudhary; Workshop Technology:, Vol I.
4. Serope Kalpakjian, ―Manufacturing Engineering and Technology‖, Pearson Education, 2018.
5. George. E. Dieter, "Mechanical Metallurgy", SI Metric Edition McGraw-Hill Book Company.

Course-Code	Course Title					Core/ Elective
U21ME303	**Thermodynamics**					**Core Course**
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
Engineering Chemistry, Engineering Physics	3	-	-	40	60	3

Course Objectives :

The objective of the course is to:

1. Basic definitions of thermodynamics and significance of Zeroth law of thermodynamics.
2. The importance and application of first law of thermodynamics.
3. The various laws associated with second law of thermodynamics.
4. Properties of pure substances and use of Mollier diagram.
5. Various air standard cycles, their importance and their comparison.

Course Outcomes :

After completing this course, the student will be able to:

1. Correlate the study of thermodynamics with the fundamental conceptual terminologies and distinguish the different forms of energy.
2. Analyze the Laws of Thermodynamics and correlate them for real life problem solving.
3. Read data from the chart of mollier diagram and its applications.
4. Assess the importance of entropy and recognize the various curves of phase transformation.
5. Identify the various air standard cycles, gas cycles and gas laws toward solving practical applications.

UNIT-I

Introduction: Definition and Concept of Thermodynamics, Microscopic and Macroscopic approach of thermodynamics, System, Surrounding, Boundaries, Universe, Control Volume, Types of Systems, intensive and extensive properties, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Displacement & Other forms of Work, Heat, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale.

UNIT-II

First law of Thermodynamics: Statement of First Law, Heat and work interactions, Thermodynamics work and Internal energy, Energy as property of system, First Law applicable to Closed system, Thermodynamic processes and calculation of work, Heat transfer, and internal energy, Heat as Path Function, first law analysis of flow processes and limitation, Calculation of work done during flow processes.

UNIT-III

Second Law of Thermodynamics: Physical description of second law, Kelvin– Planck and Clausius statement of Second Law of thermodynamics, Equivalence of Kelvin– Planck and Clausius statement, Reversible and irreversible processes, Carnot Theorem, Clausius Inequality, Calculation of entropy change during various thermodynamic processes, Entropy, T– S diagram, Available and Unavailable energies in steady flow, Second Law Analysis of Control Volume, Helmholtz and Gibb's functions, Available function for flow and non– flow processes and applications.

UNIT-IV

Thermodynamic properties of Fluids: Properties of pure substances, Concept of phase change, Graphical representation of pressure, Volume and Temperature, (PVT)– T and H diagrams, Properties of steam, Use of steam Tables and Mollier diagram, Thermodynamic relations involving entropy, Enthalpy, Internal Energy, Maxwell relations.

UNIT-V

Analysis of Thermodynamic Cycles: Air standard cycles: Otto, Diesel, Dual Combustion Cycle, Joule/ Brayton cycle. Vapour Power cycles: Rankine cycle and Modified Rankine cycle. Refrigeration cycles: Reversed Carnot cycle, Bell Coleman cycle, Vapour compression refrigeration cycle.

Suggested Readings:

1. P.K. Nag, Basic & Applied Thermodynamics, Tata Mc Graw Hill, 2nd Edn., 2008.
2. Yunus A Cengel & Michael A Boles, Thermodynamics- An Engineering Approach, Tata Mc Graw Hill, 7th Edition in SI Units (Special Indian Edition),2011
3. Y.V.C.Rao, An Introduction to Thermodynamics, Universities Press, 2nd Edn., 2010.
4. P.L Ballaney, Thermal Engineering, Khanna Publishers 2004.

Course code	Course title						Core/Elective
U21EN3L1	**Advanced Communication Skills Lab**						**Core**
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
Basic English	L	T	D	P			
	-	-	-	3	25	50	1.5

Course Objectives:

The objective of the course is to:

1. Improve the students' fluency in English, through Interpersonal Communication skills.
2. Read the given text at normal speed and analyze and evaluate critically.
3. Exhibit their ability and skills relevantly and coherently through resume writing and cover letter writing.
4. Develop oral presentation skills to meet the global competition.
5. Boost confidence through the dynamics of Group Discussion.
6. Prepare all the students for their placements through Mock Interviews.

Course Outcomes:

After completing this course, the student will be able to:

1. Organize ideas relevantly and coherently in their communication.
2. Analyze and comprehend the text inferentially.
3. Write Resume/CV and Cover letter effectively.
4. Practice oral presentation confidently.
5. Participate in group discussions dynamically and Face interviews optimistically.

1. **Activities on Fundamentals of Inter-personal Communication:** Starting a conversation, responding appropriately and relevantly – using the right body language and Role Play in different situations.
2. **Activities on Reading Comprehension:** General vs. Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading.
3. **Activities on Writing Skills:** Structure and presentation of different types of Resume/CV writing, Cover letter writing, improving one's writing of Resume and Cover letter.
4. **Activities on Presentation Skills**: Oral presentations through JAM, Extempore, Seminars and Poster Presentations.
5. **Activities on Group Discussion and Interview Skills:** a).Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation. b). Concept and Process, Pre-interview planning, opening strategies, answering strategies, interview (Types) and Mock Interviews.

Suggested Readings:

1. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
2. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
3. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi
4. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
5. Job Hunting by Colm Downes, Cambridge University Press 2008.

Course Code	Course Title						Core/Elective
U21ME3L1	**Manufacturing Processes Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Basic Physics	**-**	**-**	**-**	**3**	**25**	**50**	**1.5**

Course Objectives:

The objective of the course is to:

1. Gain knowledge and skill in various manufacturing processes such as casting, welding and forming.
2. Learn the basic operation of various manufacturing processes
3. Understand and perform operations like pattern making, sand testing and casting.
4. Understand how to join metal pieces by various welding techniques and gain hands on experience.
5. Understand the working principle and produce some components by various metal forming techniques

Course Outcomes:

After completing this course, the student will be able to:

1. Understanding the properties of moulding sands and pattern making.
2. Understand fabrication of joints using gas welding and arc welding & evaluate the quality of welded joints.
3. Identify the basic idea of press working tools and performs moulding studies on plastics.
4. Demonstrate the understanding of the theoretical concepts of above technologies while working in small groups.
5. Identity the defects / imperfections and discuss their causes and suggest remedies to eliminate them.

I. Foundry:

1. Producing different types of patterns considering draft , shrinkage and machining allowances.
2. Green sand mould making processes with complete gating and risering systems.
3. Testing of moulding sand properties.
4. Melting and pouring of lead to produce casting.

II. Welding:

1. Evaluation of strength and hardness of
   - A. Butt joint prepared by gas welding using different types of flame.
   - B. Lap joint by resistance welding process.
   - C. V-joint by Arc welding process.
2. Exercises using TIG welding processes.
3. Performing Brazing and Soldering operations.

III. Forming:

1. Performing drawing operation on Aluminum.
2. Performing blanking and piercing operations on Hydraulic Press.

IV. Processing of Plastics:

1. Manufacturing of a simple component using Plastic Injection moulding machine.

2. Manufacturing of a simple component using Plastic Blow Moulding.

Note: At least ten experiments should be completed in the semester.

Suggested Readings:

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House.

Course Code	Course Title					Core/Elective
U21ME3L2	**Machine Drawing and Modelling Lab**					**Core**
Prerequisite	Contact Hours per Week			CIE	SEE	Credits
	L	T	P/D			
Engineering Graphics & Design Practice	-	-	3	25	50	**1.5**

Course Objectives:

The objective of the course is to:

1. Understand format of drawing sheet.
2. Understand angle of projections.
3. Understand isometric projections and practice on simple machine elements.
4. Practice free hand sketching of machine elements.
5. Understand Modeling of assembly drawings of typical machine parts.

Course Outcomes:

After completing this course, the student will be able to:

1. Draw isometric views of various mechanical components.
2. Draw Orthogonal projections and sectional views of various mechanical components.
3. Draw free hand sketches of various mechanical components.
4. Understand the shape and structure of different types of joints, screws, keys and Couplings.
5. Use both the software and drafter to produce assembly views of various mechanical components from part drawings.

List of Experiments:

I. Machine Drawing (Auto CAD):

1. Format of drawing sheet & title block.
2. Conventions of drawing lines and dimensions.
3. Convention for sectional views.
4. Simple machine elements.
5. Riveted and screwed fastenings.
6. Joints and coupling.

II. Assembly drawing (SOLIDWORKS):

1. Connecting rod.
2. Eccentric.
3. Cross head.
4. Stuffing box.
5. Lathe Tool Post.
6. Revolving centre.
7. Pedestal bearing (Plummer block).
8. Screw Jack.

Note: The test is for the ability of the student to read and interpret drawing. The drawing should include part list in standard format.

Suggested Reading:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing house, Anand, New Delhi, 28th edition, 1994.
2. K.L. Narayana, P. Kannaiah, K. Venkat Reddy, Machine Drawing, New Age International (P) Ltd.,2nd edition.
3. N. Siddeshwar, Machine Drawing, Tata McGraw Hill Publishing Co. Ltd., 5th edition, 1994.
4. K. C. John, Text book of Machine Drawing, PHI Learning.

Course Code	Course Title						Core/Elective
U21CS3L1	**Programming Language-I**						**SD**
Prerequisite	Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Programming for Problem Solving	-	-	-	3	25	50	1.5

Course Objectives:

The objective of the course is to:

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, and dictionaries.
5. Read and write data from/to files in Python.

Course Outcomes:

After completing this course, the student will be able to:

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.
3. Develop Python programs step-wise by defining functions and calling them.
4. Use Python lists, tuples, dictionaries for representing compound data.
5. Read and write data from/to files in Python

List of Programming Exercises:

1. a) Write a python program for Python Variables, Executing Python from the Command Line, Editing Python Files, and Python Reserved Words.
   b) Write a python program to add two numbers.
   c) Write a program to demonstrate different number data types in python.
   d) Write a program to perform different arithmetic operations on numbers in python.
2. a) Write a python program to print a number is positive/negative using if-else.
   b) Write a python program to find largest number among three numbers.
   c) Write a Python program to swap two variables.
   d) Python Program to Print all Prime Numbers in an Interval
3. Write a python program to check whether the given string is palindrome or not.
4. a) Create a list and perform the following methods
      1) insert() 2) remove() 3) append() 4) len() 5) pop() 6)clear()
   b) Create a dictionary and apply the following methods
      1) Print the dictionary items 2) access items 3) useget () 4)change values 5) use len()
   c) Create a tuple and perform the following methods
      1) Add items 2) len() 3) check for item in tuple 4)Access items
5. a) OOP concepts: Classes, File Organization, Special Methods, Inheritance, Polymorphism,

Special Characters, Character Classes, Quantifiers, Dot Character, Greedy Matches, Matching at Beginning or End, Match Objects, Compiling Regular Expressions.

b) Write a python Program to call data member and function using classes and objects

6. a) Write a program to double a given number and add two numbers using lambda().
   b) Write a program for filter() to filter only even numbers from a given list.
   c) Write a Python Program to Make a Simple Calculator.
7. a) Demonstrate a python code to print try, except and finally block statements
   b) Write a python program to open and write "hello world" into a file and check the access permissions to that file?
   c) Python program to sort the elements of an array in ascending order and Descending order
8. a) Write a python program to open a file and check what are the access permissions acquired by that file using os module.
   b) Write a program to perform basic operations on random module.
9. Write a python program to practice some basic library modules a) numpy b) scipy
10. Introduction to basic concept of GUI Programming and Develop desktop based application with python basic Tkinter() Module?

Suggested Readings:

1. Gerald J. Kowalski, Mark T. Maybury: Information Storage and Retrieval Systems: Theory and Implementation, Second Edition Kluwer Academic Publishers
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
3. Modern Information Retrival By Yates Pearson Education.
4. Information Storage & Retieval By Robert Korfhage – John Wiley & Sons

Course Code	Course Title						Core / Elective
U21CS3L2	C Programming Lab						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Basic Computer	L	T	D	P			
	-	-	-	2	50	-	0

Course Objectives:

The objective of the course is to:

1. Understand the fundamentals of programming in C Language.
2. Write, compile and debug programs in C.
3. Formulate solution to problems and implement in C.
4. Effectively choose programming components to solve computing problems

Course Outcomes:

After completing this course, the student will be able to:

1. Choose appropriate data type for implementing programs in C language.
2. Design and implement modular programs involving input output operations, decision making and looping constructs.
3. Implement search and sort operations on arrays.
4. To decompose a problem into functions and to develop modular reusable code
5. Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
6. Design and implement programs to store data in structures and files.

List of Experiments:

1. Finding maximum and minimum of given set of numbers, finding roots of quadratic equation.
2. Sinx and Cosx values using series expansion.
3. Conversion of binary to decimal, octal, hexadecimal and vice-versa.
4. Generating Pascal triangle, pyramid of numbers.
5. Recursion: factorial, Fibonacci, GCD.
6. Matrix addition and multiplication using arrays.
7. Programs on pointers: pointer to arrays, pointer to functions.
8. Functions for string manipulations.
9. Programs on structures and unions.
10. File handling programs

Suggested Reading:

1. Byron Gottfried, “Programming with C”, Schaum’s outlines, 2nd Edition, TATA McGraw-Hill.
2. A.K.Sharma, “Computer Fundamentals and Programming in C”, 2nd Edition, University Press.
3. E Balaguruswamy, “Programming in ANSI C”, Tata McGraw-Hill Education, 2008.
4. Brian W. Kernighan and Dennis M. Ritchie, “the C Programming Language”, Prentice Hall of India, 1988.

Course code	Course title						Core/Elective
U21EN1L1	**Effective Communication Skills Lab (Common to all Branches)**						**Core**
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
Basic English	L	T	D	P			
	-	-	-	3	25	50	1.5

Course Objectives:

To enhance the listening and speaking skills of students by:

1. Giving them sufficient practice in listening with comprehension.
2. Providing them ample opportunities to improve their public speaking skills and soft skills.
3. Training them in the use of correct pronunciation, stress and intonation.
4. Sensitizing them to the use of verbal and non-verbal communication appropriate to the context.
5. Encouraging them to learn the art of conversation to suit formal and informal situation.
6. Preparing them to make formal presentations and face interviews.

Course Outcomes:

After completing this course, the student will be able to:

1. Listen, understand and interpret formal and informal spoken language.
2. Speak English with acceptable pronunciation, stress and intonation.
3. Present themselves with confidence in formal situations.
4. Participate in individual and group activities with relative ease.
5. Use verbal and nonverbal communication while using soft skills..

List of Activities

1. Listening for comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Conversation Skills
4. Introducing Oneself and Others
5. Asking for and Giving information
6. Making Request and Responding to them Appropriately
7. Giving Instructions and Responding to them Appropriately
8. Making Formal Announcement and Emceeing
9. Group Discussion
10. Just A Minute (JAM)
11. Role Play
12. Debate
13. Public Speaking Skills and Body Language
14. Interviews
15. Formal Presentations

Suggested Readings:

1. Board of Editors. Language and Life Skills Approach. Orient Black Swan,2018
2. Bala Subramaniam, T.A. Text book of English Phonetics for Indian Students, Macmillan, 1981.
3. CIEFL, Exercises in Spoken English. PART-III, Oxford University Press.
4. Pillai, Radhakrishna G. Spoken English for You – Level II. Emerald Publisher, 8th Edition.2014.
5. Sethi, J. and PV Dhamija. A Course in Phonetics and Spoken English. Prentice, India Learning Private Limited, 2nd Edition.1999
6. Robert. M. Sherfield & et al. Developing Soft Skills. Pearson Education.4th Edition. 2009.

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-21]
(w.e.f. Academic Year 2022-23)
B.E. IV-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	U21MB401	HSMC	Business Economics and Financial Analysis	3	-	-	3	40	60	3	3
2	U21ME402	PCC	Metallurgy and Material Science	3	-	-	3	40	60	3	3
3	U21ME403	PCC	Mechanics of Solids	3	-	-	3	40	60	3	3
4	U21ME404	PCC	Applied Thermodynamics	3	-	-	3	40	60	3	3
5	U21ME405	PCC	Kinematics of Machines	3	-	-	3	40	60	3	3
Practical / Laboratory Course											
6	U21ME4L1	PCC	Metallurgy and Material Testing Lab	-	-	4	4	25	50	3	2
7	U21ME4L2	PCC	Thermal Engineering Lab	-	-	3	3	25	50	3	1.5
Skill Development Course											
8	U21CS4L3	ESC	Programming Language-II	-	-	3	3	25	50	3	1.5
Total				**15**	**-**	**10**	**25**	**275**	**450**	**24**	**20**

L: Lecture (Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical **D**: Drawing (Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
ESC: Engineering Science Courses **PCC:** Professional Core Courses
EN: English **ME**: Mechanical Engineering
HSMC: Humanities & Social Sciences Including Management Courses
CS: Computer Science **MB:** Management Studies

Note:

1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment.
3. At the end of IV semester students should undergo summer Industrial Internship of two-week duration- Credits for Summer Internship will be awarded in V semester.

Course-Code	Course Title					Core/ Elective
U21MB401	**Business Economics and Financial Analysis**					-
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
Basic Mathematics	3	-	-	40	60	3

Course Objectives: Student will be able to

1. Understand the concepts of Business and Economics
2. Comprehend the concepts of market dynamics namely elasticity of demand and pricing in different market structures.
3. Gain the knowledge on the production theories and cost analysis while dealing with the production and the concept of breakeven analysis.
4. To acquire the in depth knowledge on Financial Accounting concepts and principles and preparation of final accounts.
5. To understand the financial statements through ration analysis and cash flow techniques.

Course Outcomes: Student will be able to

1. Apply the concepts of business and economics during his professional and personal life.
2. Understand the elasticity of the demand of the product, different types, and measurement of elasticity of demand and factors influencing on elasticity of demand.
3. Recognize the Production function, features of Iso-Quants and Iso-Costs, different types of internal economies, external economies and law of returns with appropriate examples.
4. Prepare the financial statements of the firm.
5. To Analyze the financial statements using ratio analysis and cash flow techniques.

UNIT – I

Introduction to Business and Economics: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance. Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II

Demand and Supply Analysis: Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting. Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT- III

Production, Cost, and 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. Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, & Cost Volume Profit Analysis.

UNIT – IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems), Introduction to Cash Flow Analysis (simple problems).

Suggested Readings:

1. A.R. Aryasri, "Managerial Economics and Financial Analysis", TMH Publications, 3nd Edition, 2007.
2. D.N. Dwivedi, "Managerial Economics", Vikas Publication House Pvt. Ltd, 2nd Edition, 2012.
3. S.N. Maheshwari & S.K.Maheshwari, "Financial Accounting", Vikas Publication House Pvt.Ltd, 4th Edition, 2012.
4. R. Narayana Swamy, "Financial Accounting- A managerial Perspective", Pearson publications, 1st Indian Reprint Edition, 2012.
5. J.V. Prabhakar Rao & P.V. Rao, "Managerial Economics & Financial Analysis", Maruthi Publishers, 1st Revised Edition, 2011.
6. M.Kasi Reddy & Saraswathi, "Managerial Economics and Financial Analysis", PHI Publications, New Delhi, 10th Revised Edition, 2012.
7. Varshney & Maheswari, "Managerial Economics", Sulthan Chand Publishers, 1st Revised Edition, 2009.

Course Code	Course Title						Core/Elective
U21ME402	**Metallurgy and Material science**						**Core**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Engineering Mechanics	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Enable to understand structure property relations, analyse the failures of metals and their prevention.
2. Broad understanding of phase diagrams.
3. Acquire basic knowledge in various heat treatment operations, their purpose and applications.
4. Expose to various methods of extractive metallurgy techniques.
5. Understand various modes of failure and suggest mechanisms for preventions of failures.
6. Understand applications of conventional metals and alloys.

Course Outcomes:

After completing this course, the student will be able to:

1. Know the fundamental science and engineering principles relevant to material.
2. Suggest appropriate physical metallurgical methods (phase diagrams).
3. The type of heat treatment operation to be given to any metal in order to improve desired Mechanical properties.
4. Basic ability to plan an extraction process for given ore.
5. Analyze the applications of conventional metals and alloys and suggest the appropriate methods for prevention of failures.

UNIT-I

Introduction: Introduction to Materials engineering, scope of metallurgy, classification of materials- metals and alloys, ceramics, polymers and composites, Bonds in solids, Space lattice, unit cell, crystal structure, crystal directions and planes, crystal imperfections- point defects, line defects, surface defects, volume defects. Types of dislocations, Hall-Petch equation, Orange peel effect, cold and hot working, strain hardening and Bauchinger effect Recovery, Recrystallisation,. Mechanical properties of materials- Tensile properties, stress-strain diagrams ,elasticity, plasticity, ductility, toughness, modulus of elasticity, resolved shear stress, tensile and compression test, hardness and its measurement, Bonds in solids.

UNIT-II

Fracture: Ductile and Brittle fracture, Fatigue: S-N curve, Structure of fatigue fracture specimen, Fatigue crack propagation, modes of fracture, ductile to brittle transition, crack initiation and propagation, Effect of metallurgical variables on fatigue of metal, Experimental determination of fatigue strength (RR-Moore Test).Creep: Creep strength, Creep curve, Creep deformation mechanisms, Creep Test, Differences between creep curve and stress rupture curve.

UNIT-III

Structure of Alloys: Types of solid solution, Substitution solids, Hume Rothary's rules for solid solution, TTT diagram, Construction and interpretation of Binary equilibrium diagram, Isomorphous, Eutectic and Peritectic diagrams, Intermediate phases and phase rule, Iron-Iron Carbide equilibrium diagram, Intermediate phases and phase rule, Iron-Iron Carbide equilibrium diagram construction and interpretation, Types of Plain Carbon Steels, Cast Iron and their properties and Characteristics.

UNIT-IV

Alloy Steels: Effects of alloying elements like Nickel, Chromium, Manganese, Silicon and Tungsten, Titanium., Study about Stainless steels, HSS, Maraging steels, Brass, Bronze, Muntz Metal, Invar, Duralumin and Ti Alloy (Ti-6Al-4V) – their composition and Properties. Introduction to Electrometallurgy.

UNIT-V

Heat Treatment: Annealing, Normalizing, Hardening, Tempering, Construction and interpretation of T.T.T Curve, Austempering and Martempering. Case Hardening: Carburizing, Nitriding, Carbo-nitriding, Flame Hardening, Induction Hardening. Brief introduction of Age Hardening, on-ferrous metals and alloys: Properties and applications of –Cu and its alloys, Al and its alloys, Age hardening, Ti and its alloys, Ni- based alloys, Ceramics, Polymers and Composites: Ceramics, crystalline ceramics, glasses, properties and applications of ceramics, polymers-polymerization, thermoplastics and thermosetting plastics, properties and applications of polymers, Composites: concept of composites, matrix and reinforcement, rule of mixtures.

Suggested Readings:

1. V.Raghavan, Material Science and Engineering, Prentice Hall of India Ltd., 4th Edition, 1994.
2. S.H. Avner, Introduction to Physical Metallurgy, Tata McGraw Hill, 2nd Edn.1997.
3. S.P. Nayak, Engineering Metallurgy and Material Science, Charotar Publishing House, 6th Edition, 1995.
4. E. Dieter, Mechanical Metallurgy, Metric Editions, Tata McGraw Hill, 3rd Edn, 1997.
5. Robert M Jones, Mechanics of Composite Materials, Taylor and Francis.

Course-Code	Course Title					Core/ Elective
U21ME403	**Mechanics of Solids**					**Core**
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
Engineering Mechanics	3	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand the basic concept of stress and strains for different materials.
2. Apply Mechanism of the development of shear force and bending moment in beams.
3. Know the theory of simple bending, direct & bending stress and distribution of shear stress.
4. Calculate normal and shear stresses, and also the behavior of thin cylinders under pressure.
5. Analyse and understand shear stress, torsional stress, Columns and Struts and their applications.

Course Outcomes:

After completing this course, the student will be able to:

1. Apply the basic concepts of stresses and strain their relations for different sections and identify the behavior of the solid bodies, composite bars, and thermal stresses and strain energy, subjected to various types of loading.
2. Apply the concepts of S.F and B.M for drawings of S.F and B.M diagrams for different beams with different loads and locate the maximum B.M and point of contra flexure and deflection.
3. Analyze Bending stresses and shear stress distribution in different sections of beams.
4. Determine Longitudinal and circumferential stresses of thin cylinder and spheres.
5. Analyze the torsional stresses developed in the shafts and also the behavior of the Columns and Struts under different loading.

UNIT – I

Simple Stresses & Strains: Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment- Construction of S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads, Point of contra flexure and Relation between S.F & B.M, Introduction to deflection of beams.

UNIT- III

Bending stresses in Beams: Assumptions made in pure bending, Derivation of bending moment equation, Moment of resistance, Determination of bending stresses. Section modulus of rectangular and circular sections (Solid and Hollow), I, T.
Distribution of shear stress: Equation of shear stress, Distribution across rectangular section, circular, triangular cross sections.

UNIT – IV

Compound Stresses: Stresses on oblique planes, Principal stresses and Principal planes. Mohr's circle and ellipse of stresses & strains.

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

UNIT - V

Torsion of Circular Shafts: Theory of pure torsion, Assumptions made, Derivation of basic torsion equation, Torsional moment of resistance, Polar section modulus, Power transmitted by shafts, combined bending and torsion.

Columns and Struts: Introduction to columns and struts, Buckling and Stability, types of supports, critical load, Euler's formulae and Rankine formulae, Equivalent length of the column, eccentric axial loads.

Suggested Reading:

1. RK Bansal, - Strength of Materials", Laxmi Publications, Delhi,2018
2. S. Ramamrutham, ―Strength of Materials", Dhanpat Rai & Sons, 1993.B.C
3. EgorP.Popov, ―Engineering Mechanics of Solids", Prentice Hall of India, NewDelhi,. Punmia, Strength of Materials and Theory of Structures, Laxmi Publishers, Delhi, 2000.
4. R.K. Rajput, ―Strength of Materials", S. Chand & Co., 2003.
5. Ferdinand P. Beer et.al., ―Mechanics of Materials", Tata McGraw-Hill Publishing Co. Ltd., New Delhi,2005

Course Code	Course Title					Core/ Elective
U21ME404	**Applied Thermodynamics**					**Core**
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
	L	T	P			
Thermodynamics	3	-	-	40	60	3

Course Objectives :

The objective of the course is to:

1. Study the application of thermal science in mechanical engineering, consisting of the fundamental laws and processes for energy conversion.
2. Understand thermal design aspects of reciprocating machinery-reciprocating compressors and IC Engines.
3. Analyse Rankine cycle applied to thermal power plants and its improvements.
4. Gain the knowledge on the power plant thermal Devices-Boilers, Condensers, Pumps¬ &Nozzle

Course Outcomes :

After completing this course, the student will be able to:

1. Expected to be able to quantify the behavior of reciprocating compressors.
2. Expected to be able to explain thermal design and working principles of IC Engines, their supporting systems and Combustion chambers.
3. Expected to be able to quantify the behavior of power plants based on the Rankine cycle, including the effect of enhancements such as superheat, reheat and regeneration.
4. Expected to be able to explain the thermal design and working principles of Power plant devices.
5. Expected to be able to explain working principles of Boilers, Condensers, and Pumps &Nozzles.

UNIT-I

Reciprocating Air Compressors: Classification and applications. Ideal and actual P-V diagrams, work input and efficiency relations for single and multi-stage compressors. Effect of clearance volume on work input and efficiency. Inter cooling and after cooling concepts.

UNIT-II

Internal Combustion Engines: Classification and applications, Working principles of four stroke and two stroke engines, Spark Ignition and Compression ignition engines, Deviation of actual cycles from Air Standard cycles. Performance parameters of I.C. Engines, Heat balance sheet of I. C. Engine. Overview of Engine supporting systems- Cooling Systems, Lubrication systems- Wet sump, Dry sump and Mist Systems. Working principles of S.I. Engine fuel systems- Carburetors, Battery and Magneto Ignition systems. Working principles of C.I. Engine fuel systems- Fuel pump and Fuel injector.

UNIT-III

I.C. Engine Combustion phenomena: Stages of combustion in S.I. Engines- Ignition delay, Flame front propagation and After burning. Abnormal combustion- Pre-ignition and Knocking. Factors affecting Knocking. Stages of

combustion in C.I. Engines, Delay period, Period of Uncontrolled Combustion, Period of Controlled Combustion and after burning. Abnormal Combustion-Knocking. Factors affecting Knocking. Octane and Cetane rating of fuels. Design considerations for combustion chamber and cylinder head. Type of combustion chambers of S.I. engines and C.I. engines.

UNIT-IV

Steam Boilers: Classification and Working Principles. Water tube boilers- Babcok & Wilcox and Stirling boilers. Fire tube boilers- Cornish, Cochran, Locomotive and Lancashire boilers. High Pressure boilers / Supercritical boilers: La-mont, Benson boiler, Loeffler boiler and Velox boiler. Boiler Mountings and Accessories: Boiler Draught, Calculation of Chimney height, Steam Condensers: Jet and Surface condensers, Principle of Operation and Applications.

UNIT-V

Steam Power Plant Cycles : Carnot and Rankine cycles of operation and their efficiencies, Analysis of Rankine cycle with superheating, reheating and regeneration (Direct and Indirect types). Steam Nozzles: Flow of steam through convergent - divergent nozzles, velocity of steam flowing through the nozzle, mass of steam discharge through the nozzle, condition for maximum discharge, critical pressure ratio and nozzle efficiency. Super saturated expansion of steam through nozzles. General relationship between area, velocity and pressure in Nozzle flow.

Suggested Reading:

1. R.K. Rajput, " Thermal Engineering", Laxmi Publications, 9th Edn., 2013
2. V. Ganesan, "Internal Combustion Engines", Tata McGraw Hill Publishing, 2007
3. P.L. Ballaney, "Thermal Engineering", Khanna Publishers, 19th Edn., 1993.
4. Richard Stone, "Introduction to I.C. Engines", Mac Millan, 2nd Edn., 1997

Course Code	Course Title					Core/ Elective
U21ME405	**Kinematics of Machines**					**Core**
Prerequisites	Contact Hours per Week			CIE	SEE	Credits
	L	T	P/D			
Engineering Mechanics	**3**	**-**	-	40	60	**3**

Course Objectives:

The objective of the course is to:

1. Differentiate the Link, kinematics chain and mechanisms.
2. Analyze the different mechanisms by graphical methods.
3. Construct the different straight Line mechanisms.
4. Draw displacement diagram for followers with various types of motions.
5. Estimate the velocity and acceleration of different type of gear and gear trains.

Course Outcomes:

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

1. Demonstrate the basic components and layout of linkages in the assembly of a system / machine & mobility of planar mechanism for finding D.O.F of mechanism & know the applications of mechanisms.
2. Perform synthesis of different mechanism by graphical methods.
3. Develop the steering gearing mechanism & Hooke's joint & can be able to determine correct steering angle, and can be able to analyze the shafts velocities in Hooke's joint.
4. Draw the displacement diagram and cam profile diagram for follower executing different types of motions and various configurations of followers
5. Draw the displacement diagram and cam profile diagram for follower executing different types of motions and various configurations of followers.

UNIT-I

Fundamentals of kinematics and Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained.

Mechanism and Machines – Mobility of Mechanisms: Kutzbach criterion , Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage

UNIT-II

Velocity and acceleration analysis: Relative velocity acceleration methods, Corioli's component of acceleration, instantaneous center of Rotation method, Kennedy theorem of three center in line, body and space centrode, Klein's construction, Position analysis of links with vector and complex algebra methods, Loop closure equation, Velocity and acceleration analysis of mechanisms using vector and complex algebra methods.

UNIT-III

Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism – Pantographs, Geneva mechanism.

Steering gear: Conditions for correct steering – Davis steering gear Ackerman's steering gear.

Hook's joint: Single and double Hooke's joint –velocity ratio – application.

UNIT-IV

Cams & Followers: Types of cams and followers, types of follower motion, Displacement, velocity and acceleration diagrams, profile of cam cams with specified contours. Analysis of uniform motion, parabolic motion, simple harmonic motion and epicycloidal motion, Design of cam profiles: Cams with knife edge, roller and flat face followers.

UNIT-V

Gears and Gear trains: Classification, Terminology, Law of Gearing, Interferences, methods of avoiding interferences, path of contact, arc of contact. Simple gear train, compound gear train, reverted gear train, planetary/epicyclic gear train, Sun and planet gear

Suggested Readings:

1. S.S. Rattan, ―Theory of Machines", Tata McGraw-Hill, 3rd Edition,2009.
2. J. E. Shigley, ―Theory of Machines and Mechanisms", McGraw-Hill Publications,2005.
3. Thomas Bevan, ―Theory of Machines", Pearson Education
4. Norton RL, ―Kinematics and Dynamics of Machinery", McGraw-Hill Publications.
5. Amitabha Ghosh and Ashok Kumar Mallik, ―Theory of Mechanisms and Machines", East West Press Pvt. Ltd,2008

Course Code	Course Title					Core/Elective
U21ME4L1	Metallurgy and Material Testing Lab					Core
Prerequisite	Contact Hours Per Week			CIE	SEE	Credits
Engineering Mechanics	L	T	P/D			
	-	-	4	25	50	2

Course Objectives :

The objective of the course is to:

1. Acquire basic knowledge by understanding iron-carbide diagram and its application in engineering.
2. Expose to Metallographic study and analysis of various metals.
3. Acquire knowledge in determining the hardness of metals before and after various Heat treatment operations.
4. Understand differences between different heat treatment methods.
5. Expose to T-T-T curve and its application in engineering metallurgy.
6. Understand the relation between micro structure and properties.

Course Outcomes:

After completing this course, the student will be able to:

1. Prepare specimen for metallographic observation
2. Analyse and identify low, medium and high carbon steels, different types of cast irons, non-ferrous alloys, from the study of their microstructure
3. Underlines the importance of grain size in evaluating the desired mechanical properties.
4. Correlate the heat treatment methods and the mechanical properties obtained.
5. Analyse and identify microstructures after annealing, normalizing, hardening and tempering Relate the properties of the materials using image analyser

List of Experiments:

A: Metallurgy Experiments:

1. Study of: Metallurgical Microscope, Iron-Iron Carbide diagram, Procedure for specimen preparation.
2. Metallographic Study of Pure Iron& Low carbon steel.
3. Metallographic Study of Medium carbon steel, Eutectoid steel & Hyper Eutectoid steel.
4. Metallographic Study of, White cast-iron, Malleable cast iron, Nodular cast iron & grey cast-iron
5. Metallographic Study of Aluminum, Brass & Bronze
6. Jominy Quench test or Study of microstructure after heat treatment

B: Materials Testing Lab

1. Uni-axial tension test, to draw stress- strain diagram, and estimate modulus of elasticity, % of elongation and toughness.
2. Compression test on bricks and Impact test.
3. Hardness test: Brinell & Rockwell.
4. Shear force & bending moment tests.
5. Bending test on cantilever, simply supported and fixed beam.
6. Spring test and torsion test.

Note: Atleast 10 experiments should be conducted

Course-Code	Course Title					Core/ Elective
U21ME4L2	**Thermal Engineering Lab**					**Core**
Prerequisites	Contact Hour per Week			CIE	SEE	Credit
Thermodynamics	L	T	P			
	-	**-**	**3**	**25**	**50**	**1.5**

Course Objectives:

The objective of the course is to:

1. Understand applications of thermal engineering concepts through experimentation.
2. Provide knowledge in testing of properties of fuels and lubricating oils.
3. Demonstrate and conduct experiments, Interpret and analyze data and report results of IC engine testing.
4. Understand the working principal of Compressors.
5. Understand the Economical Speed of Engines.

Course Outcomes:

After completing this course, the student will be able to:

1. Perform experiments to find the efficiency of Petrol and Diesel engines.
2. Find the properties of unknown fuels/lubricants.
3. Perform experiments on Reciprocating Air Compressor
4. Perform the Experiments on Heat Balance.
5. Understand the method of finding the indicated power of individual cylinders of an engine by using morse test.

List of Experiments:

1. To determine volumetric efficiency and Mechanical efficiency of a single stage reciprocating air compressor.
2. To determine Valve timing diagram of a Diesel engine.
3. To determine Port timing diagram of a Petrol engine.
4. To conduct performance test on single cylinder Diesel engine.
5. To conduct Heat balance test on a Diesel engine.
6. To conduct Performance test on a two-stroke Petrol engine.
7. To determine Economical speed Test on a SI engine.
8. To conduct Performance test on multi cylinder Petrol engine.
9. To conduct Morse test on multi cylinder Petrol engine.
10. To conduct Performance Test on Variable Compression Ratio Diesel engine.
11. Dis-assembly / Assembly of Engines.
12. Determination of viscosity of lubricating oil.
13. Determination of flash and fire points of a fuel
14. Study of Boiler Models.

Note: Atleast 10 experiments should be conducted in the Semester.

Course Code	Course Title						Elective
U21CS4L3	**Programming Language -II**						**SD**
Prerequisites	Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
PL-I	-	-	-	3	25	50	1.5

Course Objectives:

The objective of the course is to:

1. Learn simple basic library modules operations.
2. Implement Python programs using pandas.
3. Use of MATPLOTLIB library module.
4. Implement python programs using open cv.

Course Outcomes:

After completing this course, the student will be able to:

1. Develop python programs using library modules.
2. Implement python programs
3. Able to implement python programs using pandas.
4. Develop python programs using Matplotlib Module.
5. Write, Test, Debug python library modules.

List of Programming Exercises:

1. Write a python program to practice some basic operations on library modules
   a) Numpy
   b) Scipy
2. Write a Python program to demonstrate array creation techniques using
   a) list
   b) tuple
   c) resized array
3. a) Write a Pandas program to select the specified columns and rows from a given data frame.
   b) Write a Pandas program to sort the Data Frame first by 'name' in descending order, then by 'score' in ascending order.
4. a) Write a Pandas program to replace the 'qualify' column contains the values 'yes' and 'no' with True and False
   b) Write a Pandas program to change the name 'James' to 'Suresh' in name column of the Data Frame.
5. a) Write a Pandas program to insert a new column in existing Data Frame.
   b) Write a Pandas program to iterate over rows in a Data Frame.
6. a) Write a three lines of code, you can generate a basic graph using python matplotlib.
   b) Write a code how to add style to a graph using python matplotlib.
7. a) Write a code to represent the data in bar graph using python matplotlib.
   b) Write a code to represent the data in Histogram using python matplotlib
   c) Write a code to represent the data in scatter plot using python matplotlib.
8. a) Write a code to represent the data in Area plot using python matplotlib.
   b) Write a code to represent the data in pie chart using python matplotlib.
   c) Write a code to represent the data working with multiple plots using python matplotlib.
9. a) Write a program to give basic introduction about open cv library?
   b) Write a python program to draw a circle and ellipse using open cv.
   c) Write a python program to see how we can resize the image using cv_resize() .
10. Write a python program Add or Blend Two Images with different weights using open cv.