GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY: NELLORE

(AUTONOMOUS)

NELLORE–524317 (A.P) INDIA

B.TECH IN MECHANICAL ENGINEERING

(ACCREDITATED BY NBA)

COURSE STRUCTURE AND SYLLABI UNDER RG 22 REGULATIONS

DEPARTMENT VISION

To evolve as a prospective learning centre producing competent Mechanical Engineers to fulfil the ever changing needs of society and industry demands

DEPARTMENT MISSION

DM_1: To Impart comprehensive knowledge and experience in Mechanical Engineering domain through the effective implementation of Teaching-Learning methodologies

DM_2: To promote the culture of Interdisciplinary learning and facilitate Industrial training to resolve global Engineering issues

DM_3: To Impart training on modern drafting and analysis software sharpening computational capabilities and promoting higher studies

DM_4: To Initiate Industry-Institute Interface facilitating skill enhancement keeping pace with emerging industrial trends

DM_5 To Infuse moral and ethical values to groom environmentally conscious and socially responsible technocrats with professional integrity.

Program Educational Objectives (PEOs)

PEO1: Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PEO2: Pursue successful professional career in industry, academia or research.

PEO3: Engage in continuous learning to keep abreast of emerging technologies with a sense of professional commitment and ethics.

PEO4: Contribute in multi-disciplinary teams through effective inter personal skills.

Program Outcomes

PO1 **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1 **Professional Skills:** Apply the knowledge of materials and manufacturing principles to plan, design and monitor the production operations of an Industry.

PSO2 **Design Skills:** Employ the governing laws of Thermodynamics, Heat transfer and Refrigeration & Air Conditioning to design and develop Thermo Fluid systems.

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B.TECH Mechanical Engineering

Course Structure (RG22)

Semester 0

Induction Program: 3 weeks
(Common for All Branches of Engineering)

S.No	Course No	Course Name	Category	L-T-P-C
1		Physical Activities--Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2		Career Counseling	MC	2-0-2-0
3		Orientation to all branches—career options, tools, etc.	MC	3-0-0-0
4		Orientation on admitted Branch-corresponding labs, tools and platforms	EC	2-0-3-0
5		Proficiency Modules & Productivity Tools	ESC	2-1-2-0
6		Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7		Remedial Training in Foundation Courses	MC	2-1-2-0
8		Human Values & Professional Ethics	MC	3-0-0-0
9		Communication Skills—focus on Listening, Speaking, Reading, Writing skills	BSC	2-1-2-0
10		Concepts of Programming	ESC	2-0-2-0

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B.TECH Mechanical Engineering

Course Structure (RG22)

Semester - 1 (Theory-5, Lab-3)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	22A0001T	Linear Algebra and Calculus	2	1	0	3
2	BSC	22A0007T	Engineering Chemistry	3	0	0	3
3	ESC	22A0518T	C-Programming & Data Structures	3	0	0	3
4	ESC	22A0203T	Basic Electrical & Electronics Engineering	3	0	0	3
5	ESC (Lab)	22A0304P	Engineering Workshop Lab	0	0	3	1.5
6	ESC (Lab)	22A0502P	IT Workshop Lab	0	0	3	1.5
7	BSC (Lab)	22A0012P	Engineering Chemistry Lab	0	0	3	1.5
8	ESC (Lab)	22A0519P	C-Programming & Data Structures Lab	0	0	3	1.5
9	ESC (Lab)	22A0204P	Basic Electrical & Electronics Engineering Lab	0	0	3	1.5
			Total credits				**19.5**

Category	Credits
Basic Science Course (BSC)	7.5
Engineering Science Course (ESC)	12
Total	19.5

Linear Algebra & Calculus					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0001T	**2: 1:0 :0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BSC**

Course Objectives:

This course will illuminate the students in the concepts of calculus and linear algebra. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Syllabus		**Total Hours:45**
Unit - I	**Matrices**	**9 Hrs**

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Applications: Finding the current in electrical circuits Eigen values and Eigenvectors and their properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.

Unit - II	**Mean Value Theorems**	**9 Hrs**

Rolle's Theorem (Without Proof), Lagrange's mean value theorem (Without Proof), Cauchy's mean value theorem (Without Proof), related problems, Taylor's and Maclaurin theorems with remainders (without proof) - related problems, Taylor's and Maclaurin series (without proof) Expansions of functions by Taylors and Maclaurin's series.

Unit - III	**Multivariable Calculus**	**9 Hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Unit - IV	**Multiple Integrals**	**9 Hrs**

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

Unit - V	**Beta and Gamma functions**	**9 Hrs**

Beta and Gamma functions and their properties, relation between beta and gamma functions,evaluation of definite integrals using beta and gamma functions.

Course Outcomes (CO):

On completion of this course, student will be able to

- Solving the system of linear equations, find the eigen values and eigenvectors and use thisinformation to facilitate the calculation of matrix characteristics.
- Translate the given function as series of Taylor's and Maclaurin's with remainders, analyzethe behavior of functions by using mean value theorems.
- Acquire the Knowledge maxima and minima functions of several variables. Utilize Jacobian ofa coordinate transformation to deal with the problems in change of variables.

- Apply multiple integration techniques in evaluating areas and volumes bounded by the region.
- Understand beta and gamma functions and its relations, conclude the use of special function in evaluating definite integrals.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal , 44/e, Khanna Publishers, 40 edition-2017.
2. Linear Algebra & Calculus by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication 2019.

Reference Books:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India 2016.
2. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers 2012.
3. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, S. Chand Publications 2015.

Engineering Chemistry (Common to ME and CE)					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0007T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BSC**

Prerequisite: Student should know fundamental concepts about Engineering Chemistry

Course Objectives:

This course will enable students to:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers, and cement.

Syllabus	**Total Hours: 48**
Unit I - Water and its treatment	**10**

Introduction - hardness of water - causes of hardness - types of hardness: temporary and permanent - expression and units of hardness - Estimation of hardness of water by EDTA method. Numerical problems, Boiler troubles-Sludges, scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning - Softening of water : Zeolite process, ion- exchange process, Desalination of water - Reverse osmosis and Electro dialysis.

Unit–II Electrochemistry and Applications	**10**

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.
Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (Ni Cad),and lithium ion batteries- working of the batteries including cell reactions; Fuel cells: hydrogen-oxygen, methanol-oxygen fuel cells – working of the cells.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, metal oxide formation by dry corrosion-Pilling Bedworth Rule, differential aeration cell corrosion, galvanic corrosion, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Unit–III Polymers	**10**

Introduction to polymers, functionality of monomers, Types of polymerization- Addition , condensation and coordination polymerization with Mechanism.
Plastics-Definition and characteristics- thermoplastic and thermosetting plastics. Preparation, properties and applications of PVC and Nylons.
Rubbers- Natural rubber and its vulcanization - compounding of rubber. Elastomers- Preparation, properties and applications of Buna S, Buna N,
Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications.
Bio degradable polymers : poly lactic acid, Nylon-2-Nylon-6

Unit–IV Fuels and Combustion	8
Fuels – Types of fuels, solid fules-classification Calorific value of fuel - HCV, LCV and numerical problems based on calorific value, determination of calorific value by bomb calorimeter. Analysis of coal, Liquid Fuels- refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, cracking of oils, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels - composition and uses of natural gas, Producer gas and water gas.	
Unit–V Advanced Engineering Materials	**10**
Composites: Definition, classification with examples and applications. Cement: Composition, Classification, preparation (Dry and Wet processes), Setting and Hardening of Portland cement Refractories: Classification, characteristics of good refractories, properties- Refractoriness, refractoriness under load, porosity and chemical inertness – applications of refractories. Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point and Aniline point.	

Course Outcomes:

On completion of this course, the students are able to:

- Recognize the basic properties of water and its significance in domestic and industrial purposes.(L2)
- Discuss the principles of electrochemistry in batteries.(L2)
- Discuss the knowledge of corrosion of metals and methods for its prevention towards the technological applications.(L2)
- Explain polymerization and the preparation, properties, and applications of thermoplastics & thermosetting, elastomers, & conducting polymers.(L1)
- Explain calorific values, octane number, refining of petroleum and cracking of oils and Select suitable fuels for IC engines. (L1)
- Describe the various engineering materials.(L1)

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. Skoog and West G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, McGraw Hill, 2020.
2. Douglas A. Skoog, Stanley R. Crouch, F. James Holler, Principles of Instrumental Analysis, 6/e, Thomson Books, 2007.
3. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
4. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.

E-resources:

1. https://libguides.humboldt.edu/openedu/chem
2. https://libraryguides.unh.edu/oer/chemistry
3. https://libraries.etsu.edu/research/guides/chemistry/oer

C-Programming & Data Structures					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0502T	**2: 1:0 :0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

- Illustrate the basic concepts of C programming language.
- Choose a suitable C-construct to develop C code for a given problem.
- Illustrate the fundamental concept of data structures and Arrays
- Emphasize the importance of data structures in developing and implementing efficient algorithms
- Illustrate a variety of data structures such as linked structures, stacks, queues, trees, and graphs

Syllabus		**Total Hours:45**
Module - I	**Introduction to C Language**	**9 Hrs**

Structure of C program, C Tokens, Data types, Operators, Precedence and Associativity of operators, Expressions and its evaluation, control structures – sequence, selection and Iteration statements, unconditional control structures – break, goto, continue. Arrays: Introduction to arrays, types of arrays, applications of arrays, Programming examples

Module - II	**Strings, Functions and Pointers**	**9 Hrs**

String: Declaring and Initializing string, Printing and reading strings, string manipulation functions, String input and output functions, array of strings, Programming examples

Functions: Defining function, user defined functions, standard functions, passing array as argument to function, recursion

Pointers: declaring and initializing pointers, pointers and arrays, pointer to pointer, pointer arithmetic, dynamic memory allocation,

Structures and Unions

Module - III	**Data Structures**	**9 Hrs**

Introduction to Data Structures: Definitions, Concept of Data Structures, Overview of Data Structures, Implementation of Data Structures

Linked Lists: Definition, Single Linked List, Circular Linked List, Double Linked List, Circular Double Linked List, Applications of Linked List

Module - IV	**Stacks & Queues**	**9 Hrs**

Stacks: Introduction, Definition, Representation of Stack, Operations on Stacks, Applications of Stacks

Queues: Introduction, Definition, Representation of Queues, Operations on Queues, Various Queue Structures, Applications of Queues

Module - V	Trees ,Graphs ,Searching and Sorting	9 Hrs

Trees: Basic Terminologies, Definition and Concepts, Binary Tree, Representation of Binary Tree, operations on Binary Tree, Binary Search Tree, Heap Tree

Graphs: Introduction, Graph Terminologies, Representation of graphs, Operations on Graphs, Graph, Graph Traversal Techniques: BFS and DFS

Searching and Sorting – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

Course Outcomes (CO):

On completion of this course, student will be able to

- Illustrate and explain the basic computer concepts and programming principles of C language(L2)
- Select the best selection and loop construct for solving given problem(L2)
- Develop C programs to demonstrate the applications of derived data types such as arrays, pointers, strings.(L2)
- Implement basic operations on stack and queue using array representation(L2)
- Use linked structures, trees, and Graphs in writing programs(L2)
- Demonstrate different methods for traversing Graphs and Trees (L2)

Textbooks:

1. C Programming & Data Structures – Behrouz A. Fourazan, Richard F. Gilberg.
2. Programming with C – Byron Gottfried, Third edition, Scham's Outlines
3. C Programming : A Problem Solving Approach- Behrouz A. Fourazan , E.V.Prasad, Richard F. Gilberg
4. Classic Data Structures , Second Edition, Debasissamanta, PHI
5. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S.Sahni and Susan Anderson Freed, Universities Press

Reference Books:

1. Let us C,YashwantKanetkar, 6th Edition , BPB
2. C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
3. C Programming, E.Balagurusamy, 3rd edition, TMHPublishers
4. Programming in C, Ashok N. Kamthane, AmitKamthane, Pearson
5. Data Structures: A Pseudo code Approach with C, 2nd Edition, R.F.Gilberg and B. A. Forouzan, Cengage Learning.
6. "Data Structures and Algorithm Analysis in C" by Weiss
7. "Data Structure Through C" by Yashavant P Kanetkar

E-resources:

1. https://www.geeksforgeeks.org/c-programming-language/
2. http://en.cppreference.com/w/c
3. https://onlinecourses.nptel.ac.in/noc19_cs42/
4. https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial/index.html
5. https://codeforwin.org/

Basic Electrical and Electronics Engineering					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0203T	**3: 0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

To introduce the concept of electrical circuits and its components. To introduce the characteristics of various electronic devices. To impart the knowledge of various configurations, characteristics and applications of electrical & electronic components.

1) To understand the basic principles of all semiconductor devices.
2) To be able to solve problems related to diode circuits, and amplifier circuits.
3) To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
4) To be able to compare the performance of BJTs and MOSFETs.
5) To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Syllabus		**Total Hours:48**
Unit - I	**Fundamentals**	**9 Hrs**

DC&AC Circuits : Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

Unit - II	**DC & AC Machines**	**9 Hrs**

DC & AC Machines : A: DC Machines : Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC shut Motor.

B: AC Machines: Principle and operation of Single Phase Transformer-EMF equation - OC and SC tests on transformer - Principle and operation of 3-phase induction motor and alternator., [Elementary treatment only]

Unit - III	**Basics of Power Systems**	**10 Hrs**

Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical
AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary & Secondary distribution systems.

Unit - IV	**P-N Junction Diode**	**10 Hrs**

Basic Electronic Devices : P-N Junction Diode: Diode equation, Energy Band diagram, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances. Zener diode operation, Zener diode as voltage regulator.

Rectifiers : P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier.

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector configurations and Input-Output Characteristics, Comparison of CE, CB and CC configurations

Junction Field Effect Transistor and MOSFET: Construction, Principle of Operation, Symbol, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET.

Unit - V	**Junction Field Effect Transistor& Digital Electronics**	**10 Hrs**

Digital Electronics & Micro processors :
Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder.Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters
8085 Micro processor: 8085 Micro processors architecture

Course Outcomes (CO):

On completion of this course, student will be able to

- Apply KCL, KVL and network theorems to analyse DC circuit.
- Analyze the single-phase AC Circuits, the representation of alternating quantities and determining the power and power factor in these circuits..
- Comprehend the construction and Operation of DC and AC machines.
- Understand the operation of PN Junction diode and its application in rectifier circuits.
- Compare the different configurations of BJT and draw the V-I characteristics of BJT, JFET and MOSFET..

Textbooks:

1. M.Surya Kalavathi, Ramana Pilla, Ch. Srinivasa Rao, Gulinindala Suresh, **" Basic Electrical and Electronics Engineering"**, S.Chand and Company Limited, New Delhi, 1st Edition, 2017.
2. R.L.Boylestad and Louis Nashlesky, **"Electronic Devices & Circuit Theory"**, Pearson Education, 2007.

Reference Books:

1. V.K. Mehtha and Rohit Mehta, "Principles of Electrical Engineering and Electronics", S.Chand & Co., 2009.
2. Jacob Milliman, Christos C .Halkias, Satyabrata Jit (2011), "Electronic Devices and Circuits",

Engineering Workshop Lab
(Common to All Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0303	0 :0:3:0	1.5	CIE:30 SEE:70	3 Hours	ESC

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills.

Syllabus | **Total Hours:45**

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint
b) Mortise and Tenon joint
c) Corner Dovetail joint or Bridle joint

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray
b) Conical funnel
c) Elbow pipe
d) Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

a)V-fit
b) Dovetail fit
c) Semi-circular fit
d) Bicycle tire puncture and change of two wheeler tyre

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series
b) Two-way switch
c) Godown lighting
d) Tube light
e) Three phase motor
f) Soldering of wires

Course Outcomes (CO):

On completion of this course, student will be able to

- Apply wood working skills in real world applications. (l3)
- Build different objects with metal sheets in real world applications. (l3)
- Apply fitting operations in various applications. (l3)
- Apply different types of basic electric circuit connections. (l3)
- Use soldering and brazing techniques. (l2)

Note: In each section a minimum of three exercises are to be carried out.

It Workshop Lab (Common to All Branches of Engineering)					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0502P	**0: 0: 3:0**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

1. To make the students know about the internal parts of a computer, assembling and dissembling a computer from the parts, preparing a computer for use by installing the operating system
2. To provide Technical training to the students on Productivity tools like Word processors Spreadsheets, Presentations and LAteX
3. To learn about Networking of computers and use Internet facility for Browsing and Searching

Syllabus	**Total Hours:45**

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: Operating system features: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process. Networking and Internet

Task 5: Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6: Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account

and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating email account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc. Productivity tools

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

Task 9: Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

Task 10: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

Task 11: LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

Course Outcomes (CO):

On completion of this course, student will be able to

1. Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
2. Prepare the Documents using Word processors and Prepare spread sheets for calculations using excel and also the documents using LAteX.
3. Prepare Slide presentations using the presentation tool.
4. Interconnect two or more computers for information sharing.
5. Access the Internet and Browse it to obtain the required information.

Reference Books:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint& Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

Note: Use open source tools for implementation of the above exercises.

Engineering Chemistry Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0012P	**0 :0:3:0**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**BSC**

Course Objectives:

This course will enable students to:

- To Verify the fundamental concepts with experiments

Syllabus **Total Hours:45**

Note: In the following list, out of 14 experiments conduct any 10 experiments from the below list

List of Experiments

1. Determination of Hardness of a groundwater sample and mineral water sample.
2. Determination of Copper by EDTA method.
3. Conductometric estimation of strong acid using standard sodium hydroxide solution.
4. Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
5. Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.
6. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
7. Estimation of Dissolved Oxygen by Winkler's method.
8. Potentiometry - determination of redox potentials and emfs.
9. Determination of Strength of an acid in Pb-Acid battery.
10. Colorometric estimation of manganese.
11. Preparation of a polymer.
12. Determination of Viscosity of lubricating oil by Redwood Viscometer- 1
13. Determination of Viscosity of lubricating oil by Redwood Viscometer -2
14. Determination alkalinity of water sample.

Course Outcomes (CO):

On completion of this course, student will be able to

- Measure the strength of an acid present in secondary battery and Determine the rate of corrosion for mild steel in hydrochloric acid medium.(L2)
- Determine the Hardness of a groundwater sample and estimate the Copper by EDTA method. (L1)
- Determine the cell constant and conductance of solutions using conductivity meter and different acid-base titrations by pH meter. (L1)
- Synthesize of advanced polymer materials. (L2)
- Determine the potentials and EMFs of solutions by Potentiometry and Estimate the iron (II) using diphenylamine indicator. (L1)
- Determine the viscosity of different lubricants using Redwood Viscometer. (L1)

Textbooks:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – Mendham J et al, Pearson Education, 2012.

Reference Books:

1. Chemistry Practical– Lab Manual, First edition, Chandra Sekhar KB, Subba Reddy GV and Jayaveera KN, SM Enterprises, Hyderabad, 2014.
2. Engineering Chemistry Laboratory Manual, For B.Tech. I year (ME, CE)Students, Dr. A. Ravikrishna, Dr. B. Tirumalarao Sri Krishna Hitech Publishing company, Chennai, 2019.

E-resources:

1. https://guides.lib.purdue.edu/chemlabs.
2. https://chemcollective.org/.
3. http://chemistry.alanearhart.org/Lab/index.html.
4. https://www.acs.org/content/acs/en/education/students/highschool/chemistryclubs/activities/simulations.html.
5. https://instr.iastate.libguides.com/oer/chemistry.

C-Programming & Data Structures Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0519P	**0:0:3:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

This course will enable students to:

- To get familiar with the basic concepts of C programming.
- To design programs using arrays, strings, pointers and structures.
- To illustrate the use of Stacks and Queues
- To apply different operations on linked lists.
- To demonstrate Binary search tree traversal techniques.
- To design searching and sorting techniques.

Syllabus **Total Hours:45**

Note: In the following list, out of 12 experiments conduct any 10 experiments from the below list

List of Experiments

Week l

Write C programs that use both recursive and non-recursive functions

i) To find the factorial of a given integer.

ii) To find the GCD (greatest common divisor) of two given integers.

iii) To solve Towers of Hanoi problem.

Week 2

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices ii) Multiplication of Two Matrices

Week 3

a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n characters from a given position in a given string.

Week 4

a) Write a C program that displays the position or index in the string S where the string T begins, or - 1 if S doesn't contain T.

b) Write a C program to count the lines, words and characters in a given text.

Week 5

a) Write a C Program to perform various arithmetic operations on pointer variables.

b) Write a C Program to demonstrate the following parameter passing mechanisms:

i) call-by-value ii) call-by-reference

Week 6

Write a C program that uses functions to perform the following operations:

i) Reading a complex number

ii) Writing a complex number

iii) Addition of two complex numbers

iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 7

Write C programs that implement stack (its operations) using

i) Arrays

ii) Pointers

Week 8

Write C programs that implement Queue (its operations) using

i) Arrays

ii) Pointers

Week 9

Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression

ii) Evaluating the postfix expression

Week 10

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 11

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following:

i) Creating a Binary Tree of integers

ii) Traversing the above binary tree in preorder, inorder and postorder.

Week 14

Write C programs that use both recursive and non-recursive functions to perform the following

searching operations for a key value in a given list of integers:

i) Linear search

ii) Binary search

Week 15

Write a C program that implements the following sorting methods to sort a given list of integers in

ascending order

i) Bubble sort

ii) Selection sort

iii) Insertion sort

Course Outcomes (CO):

On completion of this course, student will be able to

- Demonstrate basic concepts of C programming language. (L2)
- Develop C programs using functions, arrays, structures and pointers. (L6)
- Illustrate the concepts Stacks and Queues. (L2)
- Design operations on Linked lists. (L6)
- Apply various Binary tree traversal techniques. (L3)
- Develop searching and sorting methods. (L6)

Textbooks:

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Basic Electrical & Electronics Engineering Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0204P	**0 :0:3:0**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

- To get practical knowledge about basic electrical circuits, electronic devices like Diodes, BJT, JFET and also analyze the performance of DC Motors, AC Motors and Transformers.

Syllabus	**Total Hours:45**

List of Experiments

LIST OF EXPERIMENTS: (Conduct all experiments).

Note: All the experiments shall be implemented using both Hardware and Software/ Equipment Required:

1.Verification of Kirchhoff's Laws.

2. Verification of Superposition Theorem.

3. Determination of Phase Angle for RL&RC series circuit.

4. Brake Test on DC-Shunt Motor. Determination of Performance curves.

5. OC & SC Tests on Single Phase Transformer.

6. Brake Test on Three Phase Induction Motors. Determination of Performance curves

7. V-I Characteristics of Solar Cell.

8. V-I Characteristics of PN junction Diode and Zener Diode

9. Half Wave Rectifier and Full Wave rectifier.

10. Input and Output characteristics of BJT with CE configuration

11. Input and Output characteristics of BJT with CB configuration

12. Input and Output Characteristics of JFET.

Course Outcomes (CO):

On completion of this course, student will be able to

- Experimentally verify the basic circuit theorems, KCL and KVL
- Measure power, power factor and phase angle in RL&RC circuits experimentally.
- Acquire hands on experience of conducting various tests on dc shunt motor, single phase transformers and three phase induction motors and obtaining their performance indices using standard analytical as well as graphical methods
- Draw the characteristics of different semiconductor devices like PN junction Diode, Zener Diode, BJT and JFET by conducting suitable experiments.
- Experimentally verify the working of half and full wave rectifier by using PN Junction diodes

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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B.TECH Mechanical Engineering

Course Structure (RG22)

Semester - 2 (Theory-4, Lab-5)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	22A0002T	Differential Equations and Vector Calculus	2	1	0	3
2	BSC	22A0004T	Engineering Physics	3	0	0	3
3	HSSC	22A0013T	Communicative English	3	0	0	3
4	ESC	22A0301T	Basics of Mechanical Engineering	3	0	0	3
5	ESC	22A0302T	Engineering Drawing	1	0	4	3
6	ESC (Lab)	22A0303P	Engineering Graphics Lab	0	0	3	1.5
7	HSSC(Lab)	22A0014P	Communicative English Lab	0	0	3	1.5
8	BSC (Lab)	22A0008P	Engineering Physics Lab	0	0	3	1.5
			Total credits				**19.5**

Category	Credits
Basic Science Courses	7.5
Humanities and Social Science Courses	4.5
Engineering Science Courses	7.5
Total	19.5

Differential Equations and Vector Calculus					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0002T	**2: 1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BSC**

Course Objectives:

To enlighten the learners in the concept of differential equations and multivariable calculus, to furnishthe learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Syllabus		**Total Hours:45**
Unit - I	**Linear differential equations of higher order (Constant Coefficients)**	**9 Hrs**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskean, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

Unit - II	**Partial Differential Equations**	**9 Hrs**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method. Non linear equations of first order – Type I, II, III, IV.

Unit - III	**Applications of Partial Differential Equations**	**9 Hrs**

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation (Without Derivation), Solutions one Dimensional Wave equation by the method of separation of variables and related Problems.

Unit - IV	**Vector differentiation**	**9 Hrs**

Scalar and vector point functions, vector operator del, del applies to scalar point functions- Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Unit - V	**Vector integration**	**9 Hrs**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Course Outcomes (CO):

On completion of this course, student will be able to

- Solve the linear differential equations with constant coefficients by appropriate method.
- Apply a range of techniques to find solutions of standard partial differential equations.
- Calcify the PDE, learn the applications of PDEs
- Apply del to Scalar and vector point functions, illustrate the physical interpretation of Gradient, Divergence and Curl.

- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals.

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, Differential Equations & Vector Calculus, S. Chand publication.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
3. Engineering Mathmatic I & II, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.

Engineering Physics (Common to CE and ME)					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0004T	**3: 0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BSC**

Course Objectives:

- To make a bridge between the physics in school and engineering courses.
- To impart knowledge in basic concepts of optical phenomenon like interference, diffraction and Polarisation
- To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications.
- To enlighten the periodic arrangement of atoms in crystals, Bragg's law and to provide fundamentals related to structural analysis through powder diffraction method.
- To familiarize the basic concepts of acoustics and ultrasonics with their Engineering applications.
- To explain the significant concept of magnetic materials leading to the emerging micro device applications.
- To familiarize the applications of nano and smart materials relevant to engineering branches.

Syllabus		**Total Hours:48**
Unit - I	**Wave Optics**	**10 Hrs**

Interference- Principle of superposition – Interference of light – Types of Interference – Path difference – Phase difference – Conditions for sustained interference- Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index of liquid.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to singleslit, double slit and N-slits (qualitative) – Grating spectrum.

Polarization- Introduction – Types of polarization – Polarization by reflection, refraction and doublerefraction - Nicol's Prism - Half wave and Quarter wave plates with applications.

Unit - II	**Lasers and Fiber optics**	**8 Hrs**

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Ruby laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (qualitative) – Applications

Unit - III	Crystallography and X-ray diffraction	8 Hrs

Crystallography- Space lattice, Basis, unit cell and lattice parameters – Bravais Lattice – Crystal systems – Packing fraction – Coordination number – Packing fraction of SC, BCC & FCC – Miller indices – Separation between successive (hkl) planes.

X-Ray Diffraction- Bragg's law – Bragg's X-ray diffractometer – Crystal structure determination by Powder method.

Unit - IV	Acoustics and Ultrasonics	9 Hrs

Acoustics- Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics- Introduction – Properties – Production by magnetostriction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Pulse echo system through transmission and reflection modes – Applications.

Unit - V	Engineering Materials	9 Hrs

Magnetic Materials- Introduction- basic definitions – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro –Hysteresis – Soft and Hard magnetic materials.

Nanomaterials- Introduction – Surface area and quantum confinement –Properties of Nanomaterials – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

Smart Materials- Introduction to Smart Materials- Characteristics- Types of smart materials: Smart Memory alloys (SMA)- definition- two stable solid phases: Low temperature phase (martensite transformations) - High temperature phase (austenitic transformations)- Applications of SMA.

Course Outcomes (CO):

On completion of this course, student will be able to

- Describe the importance of Interference, Diffraction and Polarization and the engineering applications as well (L2)
- Demonstrate the properties of lasers and fibre opticsto various applications in science and technology (L2)
- Explain the important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction (L2)
- Explain the fundamental properties and propagation principles of ultrasonics and acoustics in diverge engineering applications (L2)

- Explain the fundamental concepts and theory related to magnetic materials (L1)
- Illustrate diverse principles and theories of nano and smart materials and their technological applications in diverse fields (L2)

Textbooks:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.
3. Applied Physics for Engineers- K.Venkataramanan, R. Raja, M. Sundararajan(Scitech) [3,5] 2014

Reference Books:

1. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning 4. Engineering Physics – M.R. Srinivasan, New Age Publications
4. T.Pradeep "A Text book of Nano Science and Nano Technology"- Tata Mc GrawHill 2013
5. Melton, K. N, Stockel, D. and Wayman, C.M. "Engineering aspects of Shape memory Alloys", Butterworth – Heinemann, 1990.

E-resources:

- https://www.textbooks.com/Catalog/MG5/Applied-Physics.php
- https://edurev.in/courses/9596_Electromagnetic-Theory-Notes--Videos--MCQs--PPTs
- https://libguides.ntu.edu.sg/c.php?g=867756&p=6226561
- https://bookauthority.org/books/best-applied-physics-books
- https://www.electronicsforu.com/resources/16-free-ebooks-on-material-science/2

Communicative English
(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0013T	3: 0:0:0	3	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Help improve speaking skills motivating the learners to participate in activities such as role plays, discussions and structured talks/oral presentations
- Focus on appropriate reading skills for comprehension of various academic texts and authentic materials
- Impart effective strategies for good writing skills in summarizing, writing well organized essays, drafting formal letters and designing well structured reports
- Broaden the knowledge base of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Syllabus		Total Hours:48
Unit - I	**On the Conduct of Life: William Hazlitt**	**9 Hrs**

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text Scanning to look for specific pieces of information.

Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary: Parts of Speech,

Content words and function words;

Word order in sentences;

Basic sentence structures;

Types of questions - Wh- questions.

Unit - II	**The Brook: Alfred Tennyson**	**9 Hrs**

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar and Vocabulary: Use of Articles and zero Article
Prepositions
Punctuation, capital letters
Cohesive devices - linkers

Unit - III	**The Death Trap: Saki**	**11 Hrs**

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed
Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Paragraph Writing , Summarizing
Grammar and Vocabulary: Verbs - Tenses
Subject-Verb agreement
Direct & Indirect speech

Unit - IV	**Innovation: Muhammad Yunus**	**10 Hrs**

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Read and Interpret graphic Information to reveal trends/patterns/relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters/Report Writing
Grammar and Vocabulary: Adjectives and Adverbs; Comparing and Contrasting
Voice - Active & Passive Voice.

Unit - V	**An Astrologer's Day: R. K. Narayan**	**8 Hrs**

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts- without the use of PPT slides
Reading: Reading for Comprehension
Writing: Writing structured essays on specific topics using suitable claims and evidences.
Grammar and Vocabulary: Identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Course Outcomes (CO):

On completion of this course, student will be able to

- Retrieve the knowledge of basic grammatical concepts
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions

- Evaluate listening /reading texts and to write summaries based on global comprehension of these texts.
- Create and develop coherent paragraph interpreting graphical description.

Textbooks:

1. Language and Life: English Skills for Engineering Students - Orient Black Swan

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)

Web links:

1. www.englishclub.com
2. www.easyworldofenglish.com
3. www.languageguide.org/english/
4. www.bbc.co.uk/learningenglish
5. www.eslpod.com/index.html

Basics of Mechanical Engineering					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0301T	**3: 0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

- Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints.
- Expose to various mechanical property measuring techniques.
- Provide insights on various metal cutting processes. (Lathe, drilling, milling).
- Expose to various linear and angular measuring techniques.
- Introduce to the concepts of fluid statics and dynamics.
- Impart the knowledge on selection of various types of fluid machinery.
- Impart knowledge on Conservation of energy.
- Impart the knowledge on selection of boilers for different operating pressure.
- Provide insights on working of IC engines.

Syllabus		**Total Hours:49**
Unit - I	**Basics of Mechanical Engineering**	**12 Hrs**

Classification of engineering materials: Cast iron- Classification of cast iron-Grey cast iron-White cast Iron- Ductile cast iron-Malleable cast iron-Carbon steels-Plain carbon steel-Classification of plain carbon steel-Alloy steel-Effect of alloying elements in steel-Classification of alloy steel-Iron carbon diagram

Properties of materials: Mechanical properties-Stress: Classification of stress-Strain: Classification of strain- Simple problems on stress and strain

Materials testing: Tensile test-stress - strain diagram of mild steel material- Shear test-Brinell's hardness test-Vicker's hardness test-Fatigue failure: factors affecting the fatigue strength-Fatigue testing

Unit - II	**Mechanical Measurements**	**10 Hrs**

Temperature measurement: Temperature measuring Instruments-Thermal expansion-Electrical Resistance thermometers-Thermo-Electric thermometers-Radiation method

Pressure Measurement: Moderate pressure measurement using Manometers- Moderate pressure measurement using Elastic Elements-Low pressure or vacuum measurement- High pressure measurement

Velocity measurement: Measurement of linear velocity- Measurement of angular velocity

Flow measurement: Positive Displacement meter-Differential Pressure Flow meter-Rotameter

Strain measurement: Measurement of strain using Electrical resistance strain gauge

Torque measurement: Measurement of torque using Transmission dynamometers and

Absorption dynamometers

Errors in measurement: Classification of errors-Uncertainties

Unit - III	Machine Tools and Metrology	9 Hrs

Lathe: Classification of Lathe-Lathe specifications-Lathe accessories-Lathe operations-Drilling machine: Classification of Drilling machines-Drilling machine specifications-Drilling machine operations-Milling machines: Milling machines-Classification of Milling machines- Milling machine specifications-Types of Milling cutters-Milling operations-Shaping machines: Classification of shaping machines- Shaping machine specifications-Construction and main parts- Quick return mechanism

Metrology: Accuracy and Precision-Vernier Calipers: Construction-Least count of Vernier calipers-Determination of the length of a rod-Applications-Micrometer: Types of Micrometers-Construction-Pitch of a Micrometer-Least count of a Micrometer-Determination of Zero Error of a micrometer-Determination of diameter of a wire using Micrometer-Applications-Slip gauges-Sine Bar: Construction-Working principle-Applications-Dial gauge: Construction-Applications

Unit - IV	Fluid Mechanics and Fluid Machinery	9 Hrs

Properties of Fluids: Pressure or intensity of Pressure-Mass density or Density or Specific mass-Weight density or Specific weight-Specific volume-Specific gravity-Viscosity-Newton's law of viscosity-Kinematic viscosity-Pascal's law: Pressure variation with depth-Hydrostatic law-Continuity Equation-Bernoulli's Equation for Incompressible fluids-Viscous flow-Turbulent flow

Hydraulic Turbines: Pelton wheel-Francis Turbine-Kaplan Turbine-Pumps: Kinetic Energy Pump-Positive Displacement Pump-Fluid Coupling-Compressors: Positive displacement compressors-Dynamic compressor- Pneumatic Machinery: Pneumatic components-Applications

Unit - V	Laws of Thermodynamics, Boilers and IC Engines	9 Hrs

First law of thermodynamics: First law of thermodynamics for a closed system undergoing a change of state-Corollaries of first law of thermodynamics-Limitations of first law of thermodynamics-Second law of thermodynamics: The Kelvin-Planck statement-Clasius statement-Equivalence of Kelvin-Planck and Clasius statements-PMM-II

Boilers: Classification of Boilers-Cochron Boiler: Construction-Working-Adnatages-Limitations- Lancashire Boiler: Construction-Working-Adnatages-Limitations- Bobcock and Wilcox Boiler: Construction-Working-Adnatages-Limitations-Differences between Water tube and Fire tube boilers

IC Engines: Working of Four stroke Diesel Engine- Working of Four stroke Petrol Engine-Working of Two stroke Diesel Engine- Working of Two stroke Petrol Engine-Comparisons of Two stroke and Four stroke engines-Comparisons between External and Internal Combustion Engines.

Course Outcomes (CO):

On completion of this course, student will be able to

- Select steels and cast irons for a given engineering application.
- Determine the simple stresses and deformations due to axial loads in members
- Evaluate the properties of materials.
- List various measuring instruments used in metrology
- Identify the methods of cutting process to generate different types of surfaces.
- Measure force, torque, temperature, pressure and strain.
- Estimate the fluid properties under laminar and turbulent flows.
- Select the type of turbine required for different flow conditions.
- Explain the importance of thermodynamic properties related to conversion of heat energy into work.
- Select the type of boiler required for different operating conditions.
- Explain the working of IC engines relevant to combustion process.

Textbooks:

1. Basic Mechanical engineering by Basant Agarwal and CM Agarwal, Wiley India Pvt Limited, 2008
2. Basic Mechanical engineering by R.K Rajput, Lakshmi Publication Pvt Ltd, New Delhi, 2003
3. Basics of Mechanical engineering by Rishi singal and Mridul Singal, IK International Publishing House Pvt Ltd, 2007

Reference Books:

1. Basic Mechanical engineering By M. P. Poonia and S.C. Sharma, Kanna Book Publishing company Pvt Ltd, 2019
2. Basic Mechanical Engineering by Pravin Kumar, Person Publications, 2013
3. 3. Basics of Mechanical engineering by R.rajesh Kumar, Jyothis Publishers, 2016

Engineering Drawing
(Common to all Branches of Engineering)

Course Code	L:T:P/D:S	Credits	Exam marks	Exam Duration	Course Type
22A0302T	1: 0: 0/4 :0	3	CIE:30 SEE:70	3 Hours	ESC

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.

Syllabus		Total Hours:50
Unit - I	Introduction to Engineering Drawing	10 Hrs

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance- Conventions in drawing-lettering - BIS conventions.

a) Draw the Conic sections including Ellipse, Parabola, Hyperbola, and the Rectangular hyperbola using general methods,
b) Draw the Cycloid, Epicycloids, and Hypocycloid
c) Draw the Involutes of circle, square, pentagon, and hexagon

Unit - II	Projections of points, lines and planes	10 Hrs

Projections of points, lines, and planes: Projection of points in any quadrant, lines inclined to one and both planes, finding true lengths, finding true inclinations, angle made by line. Projections of regular plane surfaces using rotating plane method.

Unit - III	Projections of Solids	10 Hrs

Projections of solids: Projections of regular solids inclined to one and both the principle planes using auxiliary views method.

Unit - IV	Sections of solids	10 Hrs

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

Unit - V	Development of surfaces	10 Hrs

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

Course Outcomes (CO):

On completion of this course, student will be able to

- Draw various curves applied in engineering. (l2)
- Show projections of solids and sections graphically. (l2)
- Draw the development of surfaces of solids. (l3)

Textbooks:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Engineering Graphics Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0303P	**0 :0:3:0**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

This course will enable students to:

- Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling.
- Instruct graphical representation of machine components.

Syllabus	**Total Hours:39**

Computer Aided Drafting:

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

Orthographic Projections: Systems of projections, conventions and application to orthographic projections - simple objects.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Course Outcomes (CO):

On completion of this course, student will be able to

- Use computers as a drafting tool. (L2)
- Draw isometric and orthographic drawings using CAD packages. (L3)

Text books

1. K.L. Narayana, Bheemanjaneyulu, Engineering Graphics with Autocad, New age International Publishers, 2018.
2. T Jeyapoovan , Engineering Graphics Using Autocad, Vikas Publishing House, 2015
3. Dr. C. Elanchezhian and Dr. B. Vijaya Ramnath , Engineering Graphics Using AutoCAD, Medtech; 7/e, 2018
4. H. M. Allen , Engineering Graphics Using Autocad Course Manual, Ronjon Pub; 2/e,1993
5. Dennis E. Maguire , Engineering Drawing from First Principles: Using AutoCAD, Butterworth-Heinemann, 1998

Communicative English Lab
(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0014P	0 :0:3:0	1.5	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

This course will enable students to:

- Students will be exposed to a variety of self instructional, learner friendly modes of language learning
- Students will learn better pronunciation through sounds, stress, intonation and rhythm
- Students will be trained to use language effectively to face interviews, group discussions, public speaking
- Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc.

Syllabus **Total Hours:48**

List of Experiments

1. Phonetics
2. Describing objects/places/persons
3. Role Play or Conversational Practice
4. JAM
5. Etiquettes of Telephonic Communication
6. Group Discussions
7. Debates
8. Oral Presentations
9. Interviews Skills
10. Reading comprehension
11. E-mail Writing
12. Resume Writing

Course Outcomes (CO):

On completion of this course, student will be able to

- Listening and repeating the sounds of English Language
- Understand the different aspects of the English language proficiency with emphasis on LSRW skills
- Apply communication skills through various language learning activities
- Analyze the English speech sounds, syllable division, stress, rhythm, intonation for better Listening and Speaking Comprehension.
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it in order to Improve fluency in spoken English.

Suggested Software: Walden InfoTech / Young India Films

Reference Books:
1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014. 2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018. 3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012. 5. A Textbook of English Phonetics for Indian Students by T. Balasubramanyam
Online Learning Resources/Virtual Labs:
1. www.esl-lab.com 2. www.englishmedialab.com 3. www.englishinteractive.net

Engineering Physics Lab (Common to CE and ME)					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0008P	**0 :0:3:0**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**BSC**

Course Objectives:

This course will enable students to:

- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application infinding the particle size.
- Illustrates the magnetic and dielectric materials applications.

Syllabus	**Total Hours:48**

Note: In the following list, out of 12 experiments, any 2 experiments must be performed in a virtual mode

List of Experiments

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of dispersive power of prism.
5. Determination of wavelength of LASER light using diffraction grating.
6. Determination of particle size using LASER.
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
8. Determination of dielectric constant by charging and discharging method.
9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
10. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
11. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
12. Sonometer: Verification of the three laws of stretched strings

Course Outcomes (CO):

On completion of this course, student will be able to

- Determine the radius of a curvature and / or thickness of thin wire using microscope with the helpof interference concept (L2)

- Evaluate the wavelength of various colors of grating and also dispersive power of prism by spectrometer using the principle of diffraction (L2)
- Evaluate wavelength of light source and particle size with He-Ne laser using the principle of diffraction Estimate the numerical aperture of a given optical fiber and hence to find its acceptance angle (L2)
- Estimate the dielectric constant of a given material (L2)
- Examine the hysteresis loss of the magnetic material by B- H curve and Estimate the magnetic field of a circular coil carrying current along the axis (L2)
- Estimate the mechanical properties of given string using Torsional pendulum and sonometer (L2)

Textbooks:

1. Engineering Practical Physics B Mallick S Panigrahi, 1st, Edition, Cengage Learning Publishers
2. A Text book of Engineering Physics Practical, Dr. Ruby Das, Dr. Rajesh Kumar, C. S. Robinson, Prashant Kumar Sah, UNIVERSITY SCIENCE PRESS (An Imprint of Laxmi Publications Pvt. Ltd.)

Reference Books:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017

E-resources:

1. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University
2. https://www.scribd.com/doc/81569075/Physics-Lab-Manual
3. http://www.mlritm.ac.in/assets/img/Lab%20manual%20Physics.pdf
4. https://bmsit.ac.in/public/assets/pdf/physics/studymaterial/Physics%20lab%20manual_cbcs%20%20-%20kavichintu.pdf

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Mechanical Engineering
II B.TECH.

Semester-III (Theory–6, Lab–3, Skill Course-1, Mandatory Course-1)							
S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	22A0015T	Complex Variables, & Numerical methods	BSC	2	1	0	3
2.	22A0305T	Manufacturing Processes	PCC	3	0	0	3
3.	22A0307T	Material Science & Engineering	PCC	3	0	0	3
4.	22A0309T	Engineering Mechanics	PCC	2	1	0	3
5.	22A0310T	Thermodynamics	PCC	2	1	0	3
6.	22A0022T	Managerial Economics and Financial Analysis	HSSC	3	0	0	3
7.	22A0306P	Manufacturing Processes Lab	PCC	0	0	3	1.5
8.	22A0308P	Material Science and Engineering Lab	PCC	0	0	3	1.5
9.	22A0311P	Solid Modeling Lab	PCC	0	0	3	1.5
10.	22A0539P	**Skill oriented course** Java programming	SOC	1	0	2	2
11	22A0028M	**Mandatory Course–I** Environmental Science	MC	2	0	0	0
						Total	**24.5**

Distribution of Credits among the Category of Courses		
S.No	Category of Courses Introduced	Credits Assigned
1	Basic Science Courses (1T)	3
2	Professional Core Courses (4T+1L)	16.5
3	Humanities and Social Science Courses (1T)	3
4	Skill Oriented Course - 1 (T+P)	2
5	Mandatory Non Credit Course (1T)	0
Total Credits		24.5

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Mechanical Engineering

Complex Variables, & Numerical methods					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0015T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**BSC**

Course Objectives:

- This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The aim is to analyze the solutions of partial differential equations.

Syllabus		**Total Hours:44**
Unit-I	**Complex Variable – Differentiation:**	**9Hrs**

Introduction to functions of complex variable-concept of Limit & continuity-Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method- Conformal mappings-standard transformations (ez, , kz) Mobius transformations (bilinear) and their properties.

Unit-II	**Complex Variable – Integration:**	**9Hrs**

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with f(z) not having poles on real axis).

Unit-III	**Laplace Transforms**	**9Hrs**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Unit-IV	**Fourier series**	**8Hrs**

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions– Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms -Parseval's formula- Complex form of Fourier series.

Unit-V	**Partial Differential Equations & Applications**	**9Hrs**

Solution of second order PDEs by Method of separation of variables – Solutions of one dimensional wave equation, one dimensional heat equation under initial and boundary conditions. Steady statetwo dimensional heat equations (Laplace equations).

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply cauchy's integral formula and cauchy's integral theorem to evaluate improper integrals along contours.
- Understand the usage of laplace transforms.
- Evaluate the fourier series expansion of periodic functions.
  Formulate/solve/classify the solutions of partial differential equations and also find the solution of one-dimensional wave equation and heat equation.

Textbooks:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 42nd edition 29 September 2017.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India, 10th edition 16 August 2011.

Reference Books:

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers, 1 July 2017.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier, 1st Edition, June 13, 2001.

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Mechanical Engineering

Manufacturing Processes					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0305T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To introduce the students to working principle of different metal casting processes and gating system.
- To impart knowledge on plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- To teach principles of forging, tools and dies, working of forging processes.
- To develop fundamental understanding on classification of the welding processes, working of different types of welding processes and welding defects.
- To impart knowledge on manufacturing methods of plastics, ceramics and powder metallurgy.
- To introduce the basic concepts of Unconventional Machining Processes.

Syllabus		**Total Hours:42**
UNIT - I	**Casting Processes**	**8 Hrs**

Introduction: Importance and selection of manufacturing processes.

Introduction to casting process, process steps; pattern and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

UNIT - II	**Metal Forming & Forging**	**8 Hrs**

Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.

Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

UNIT - III	**Metal Joining Processes**	**8 Hrs**

Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding. applications, advantages and disadvantages of the above processes, Plasma Arc welding, Laser Beam Welding, Electron Beam Welding and Friction Stir Welding. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies.

UNIT - IV	Plastic Processing, Ceramics and Powder Metallurgy	8 Hrs

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding, and blow molding

Ceramics: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Powder Metallurgy: Principle, manufacture of powders, steps involved.

UNIT - V	Unconventional Machining Processes	10 Hrs

principle and processes parameters of Electrical discharge machining (EDM), electro-chemical machining (ECM), Laser beam machining (LBM), plasma arc machining (PAM), electron beam machining, Abrasive jet machining (AJM), water jet machining (WJM), and ultrasonic machining(UM)

Course Outcomes (CO):

On completion of this course, student will be able to

- Demonstrate different metal casting processes and gating systems. (L2)
- Classify working of various welding processes. (L2)
- Evaluate the forces and power requirements in rolling process. (L5)
- Apply the principles of various forging operations. (L3)
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy. (L1)
- Identify different unconventional processes and their applications. (L3)

Textbooks:

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

1. Sidney H.Avner , Introduction to Physical Metallurgy, McGraw Hill Education,2 /e, 2017.
2. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
3. Sharma P.C., A Text book of Production Technology, S Chand Publishing,8/e, 2014.

Web links:

1. https://www.digimat.in/nptel/courses/video/112107145/L01.html
2. https://www.digimat.in/nptel/courses/video/112105126/L01.html

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Material Science & Engineering					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0307T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams.
- Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints.
- Explain the methods to change the properties of materials through heat treatment processes.
- Familiarize properties and applications of ceramics, polymers and composite materials.
- Demonstrate the fundamental properties of nano-materials and their applications.

Syllabus		**Total Hours:42**
UNIT - I	**Metals & Alloys**	**8 Hrs**

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions-Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-Iron-carbide diagram and micro structural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT - II	**Metal Forming & Forging**	**8 Hrs**

Steels:
Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Microstructure, properties and applications of alloy steels-stainless steels and tool steels.
Cast irons:

Microstructure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT - III	**Heat Treatment of Steels**	**8 Hrs**

Heat Treatment of Steels: Annealing, tempering, normalizing and hardening, isothermal transformation diagrams for Fe-Fe3C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening - carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

UNIT - IV	Non-ferrous Metals and Alloys	8 Hrs
Non-ferrous Metals and Alloys: Microstructure, properties and applications of copper, aluminium, titanium, nickel and their alloys. Study of Al-Cu phase diagram		
UNIT - V	**Ceramics, Polymers and Composites**	**10 Hrs**
Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.		

Course Outcomes (CO):

On completion of this course, student will be able to

- Explain the principles of binary phases. (l2)
- Select steels and cast irons for a given application. (l3)
- Apply heat treatment to different applications. (l3)
- Utilize nonferrous metals and alloys in engineering. (l3)
- Choose composites for various applications. (l3)
- Assess the properties of nano-scale materials and their applications. (l2)
- Differentiate between hardening of ferrous and non-ferrous alloys. (L4)

Textbooks:

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. R.Balasubramaniam, Callister's Material Science and Engineering, 2/e, Wiley India, 2014.

Reference Books:

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

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Engineering Mechanics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0309T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- Explain the effect of force and moment in different engineering applications.
- Find the centre of gravity and moment of inertia of solids and surfaces.
- Familiarize frictional forces in mechanical applications.
- Analysis of rigid bodies under dynamic conditions.

Syllabus		**Total Hours:49**
Module-I	**Introduction to types of forces and Friction**	**12Hrs**

Introduction to Engineering Mechanics: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

Module-II	**Analysis of Structures and Virtual Work**	**10Hrs**

Analysis of Structures: Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

Virtual Work: Equilibrium of ideal systems, work done by a force, work done by a couple, principle of virtual work.

Module-III	**Properties of Surfaces and Volumes and Moment of Inertia**	**9Hrs**

Properties of Surfaces and Volumes: Centroid and center of gravity, derivation of centroids from first moment of area, centroids of composite sections, center of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guidinus.

Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes -thin plates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

Module-IV	**Kinematics**	**9Hrs**

Kinematics: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, motion under gravity -projectile motion, use of rectangular coordinates, tangential and normal coordinates, radius of curvature, rotation of a rigid body about a fixed axis, introduction to plane motion.

Module-V	Kinetics	9Hrs

Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

Ideal Systems: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse, impact - types of impact.

Course Outcomes (CO):

On completion of this course, student will be able to

- Resolve forces and couples in mechanical systems.(L3)
- Identify the frictional forces and its influence on equilibrium.(L3)
- Find the centre of gravity and moment of inertia for various geometric shapes(L3)
- Develop equations for different motions.(L4)
- Determine the displacement, velocity and acceleration relations in dynamic systems(L4)
- Relate the impulse and momentum (L4)

Textbooks:

1. S S Bhavikatti, “Engineering Mechanics”, 4th edition, New Age International, 2008.
2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, “Engineering Mechanics (in SI units)”, 5th edition, McGraw Hill, 2013.

Reference Books:

1. Basudeb Bhattacharya., “Engineering Mechanics”, 2nd edition, Oxford University Press (India), 2015.
2. Irving Shames, G K M Rao, “Engineering Mechanics: Statics and Dynam-ics”, 4th edition, Pearson, 2009.
3. K L Kumar, Veenu Kumar, “Engineering Mechanics”, 4th edition, Tata McGraw Hill, 2010.

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Mechanical Engineering

Thermodynamics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0310T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To introduce the concepts of heat, work, energy and governing rules for conversion of one form to other.
- To explain relationships between properties of matter and basic laws of thermodynamics.
- To teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To introduce the concept of available energy for maximum work conversion.
- To impart knowledge on steam properties.
- To provide fundamental concepts of air standard cycles used in IC engines and gas turbines.

Syllabus		**Total Hours:42**
UNIT - I	**First law of Thermodynamics**	**10 Hrs**

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics and Temperature measurement.

Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics**.**

UNIT - II	**Second Law of Thermodynamics**	**8 Hrs**

Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

UNIT - III	**Entropy, Availability and Irreversibility**	**8 Hrs**

Clausius inequality - Concept of Entropy- entropy equation for different processes and systems. Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steadyflow, non-flow processes and irreversibility.

Maxwell relations, TdS equations difference in heat capacities, ratio of heat capacities.

UNIT - IV	**Properties of Steam and use of Steam Tables**	**8 Hrs**

Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry. Energy equation, Joule Thompson coefficient Clausius - Clapeyron equation.

UNIT - V	Air Standard Cycles	8 Hrs

Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles, Comparison of Brayton and Otto Cycles.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the importance of thermodynamic properties related to conversion of heat energy into work. (L1)
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles. (L3)
- Utilize steam properties to design steam based components. (L4)
- Analyze thermodynamic relations and air standard cycles. (L5)

Textbooks:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

Reference Books:

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010

Web links:

1. https://nptel.ac.in/courses/112/105/112105266/
2. https://nptel.ac.in/courses/112/104/112104113/

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)
NELLORE – 524137 (A.P) INDIA
Mechanical Engineering

Managerial Economics and Financial Analysis					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0022T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**HSSC**

Course Objectives:

- To understand the concepts of managerial economics and financial analysis this helps in optimal decision making in business environment.
- To have a thorough knowledge on the production theories and cost while dealing with the production and factors of production.
- To have a thorough knowledge regarding market structure and forms of business organizations in the market.
- To understand the concept of capital and capital budgeting in selecting the proposals.
- To have a thorough knowledge on recording, classifying and summarizing of transactions in preparing of final accounts.

Syllabus		**Total Hours:48**
Module-I	**Introduction To Managerial Economics &Demand**	**9 Hrs**

Managerial Economics – Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand - Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Module-II	**Theory Of Production And Cost Analysis**	**9 Hrs**

Production Function – Least-cost combination - Short-run and Long-run Production Function - Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale - Cost concepts and Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

Module-III	**Introduction to Markets And forms Of Business Organiztions**	**10 Hrs**

Market structures - Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Price-Output Determination - Pricing Methods and Strategies - Forms of Business Organizations - Sole Proprietorship - Partnership - Joint Stock Companies - Public Sector Enterprises-.

Module-IV	**Capital And Capital Budgeting**	**10 Hrs**

Concept of Capital - Significance - Types of Capital - Components of Working Capital Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Module-V	Introduction to Financial Accounting and Analysis	10 Hrs

Accounting Concepts and Conventions - Introduction Double-Entry Book Keeping, Journal, Ledger, and Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Course Outcomes (CO):

On completion of this course, student will be able to

- Outline the Managerial Economic concepts for decision making and forward planning. Also know law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services. (L2)
- Assess the functional relationship between Production and factors of production and list out various costs associated with production and able to compute breakeven point to illustrate the various uses of breakeven analysis. (L5)
- Outline the different types of business organizations and provide a framework for analyzing money in its functions as a medium of exchange. (L2)
- Interpret various techniques for assessing the proposals of project for financial position of the business. (L2)
- Identify the principles of accounting to record, classify and summarize various transactions in books of accounts for preparation of final accounts. (L3)

Textbooks:

1. Managerial Economics, PL Mehata, Sulthan Chand Publications, 21e, 2016

Reference Books:

1. Ahuja Hl “Managerial economics” 3 rd edition, Schand, ,2013
2. S.A. Siddiqui and A.S. Siddiqui: “Managerial Economics and Financial Analysis”, New Age International,. 2013.
3. Joseph G. Nellis and David Parker: “Principles of Business Economics”, 2nd edition, Pearson, New Delhi,2/e,2007
4. Domnick Salvatore: “Managerial Economics in a Global Economy”, Cengage, 2013.
5. Managerial Economics, Varshney &Maheswari, Sultan Chand, 2013.
6. Managerial Economics and Financial Analysis, Aryasri, 4th edition, MGH, 2019

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Manufacturing Processes Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0306P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- Acquire practical knowledge on Metal Casting, Welding, Press Working and unconventional machining Processes

Syllabus **Total Hours:45**

1. **METAL CASTING**
   a) Gating Design and pouring time and solidification time calculations.
   b) Sand Properties Testing – Exercise for Strength and Permeability.
   C) Molding, Melting and Casting for ferrous/ non ferrous materials.
2. **WELDING**
   a) TIG Welding.
   b) MIG Welding.
   c) Friction stir welding.
   d) Any other Special Welding Processes.
3. **MECHANICAL PRESS WORKING**
   a) Press Tool: Blanking and Piercing operation with Simple, Compound and Combination dies.
   b) Closed die forging, Deep Drawing and Extrusion operations.
4. **UN CONVENTIONAL MANUFACTUNRING PROCESSES**
   a) Electro Discharge Machining (EDM) / Wire cut EDM
   b) Plasma arc cutting / Abrasive jet machining (AJM)

Additive manufacturing with reverse engineering

Course Outcomes(CO):

On completion of this course, student will be able to

- Fabricate different types of components using various manufacturing techniques. (L6)
- Adapt unconventional manufacturing methods. (L6)

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Material Science and Engineering Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0308P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To understand the microstructure and hardness of engineering materials.
- To explain grain boundaries and grain sizes of different engineering materials.

Syllabus **Total Hours:45**

1. Metallography sample preparation
2. Microstructure of pure metals – Iron, copper and aluminum as per ASTM standards
3. Microstructure of low carbon steel, mild steel and high carbon microstructure of cast irons.
4. Microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.
5. Hardenability of steels by Jominy End Quench Test.
6. Microstructure of heat treated steels.
7. Hardness of various untreated and treated steels.
8. Microstructure of ceramics, polymeric materials.
9. Microstructure of super alloy and nano-materials.
10. Hardness of ceramics, super alloys, nano-materials and polymeric materials (one sample on each)

Course Outcomes (CO):

On completion of this course, student will be able to

- Differentiate various microstructures of ferrous and non-ferrous metals and alloys. (l4)
- Visualize grains and grain boundaries. (l3)
- Importance of hardening of steels. (l2)
- Evaluate hardness of treated and untreated steels. (l4)
- Differentiate hardness of super alloys, ceramics and polymeric materials(l2)

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Solid Modeling Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0308P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To impart hands on training for drafting , modeling and assembly of machine parts using modeling package.

Syllabus — **Total Hours:45**

1. Drafting of cotter joint
2. Drafting of coupling
3. Drafting of bearing
4. Drafting of riveted joint
5. Modeling and assembly of stuffing box parts.
6. Modeling and assembly of steam engine cross head parts.
7. Modeling and assembly of lathe single way tool post parts.
8. Modeling and assembly of knuckle joint parts.
9. Modeling and assembly of plummer block parts
10. Modeling and assembly of screw jack parts
11. Modeling and assembly of IC engine piston parts
12. Modeling of parts of Eccentric and generation of orthographic views.

Course Outcomes (CO):

On completion of this course, student will be able to

- Draft Different Views Of Machine Elements And Parts
- Model Individual Parts And Assemble Them.

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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Mechanical Engineering

Java Programming
(Common to EEE,ME and ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0539	1: 0:2:0	2	CIE: 30 SEE:70	3Hours	SC

Course Objectives:

This course will enable students to:

- To introduce the fundamental concepts of object-oriented programming to design & implement object oriented programming concepts in Java.
- To obtain knowledge about the principles of inheritance and polymorphism
- Learn the usage of Control structures in java
- To implement the concept of Array, interfaces, exception handling
- To understand the usage of Threads in java

Syllabus | **Total Hours:48**

Module : 1

Fundamentals of Object Oriented Programming: Introduction, Object Oriented Paradigm, Basic concepts of OOP : Class, Object, Inheritance, Polymorphism, Abstraction, Encapsulation..

Task: introduction to Object Oriented Programming and its basic concepts.

Module : 2

Overview of Java Language: Introduction, Java features, Java program structure, parts of Java, Java Virtual Machine-Java versus C++, How to Compile & Executing a basic java program.

Task: Differences between Java and C++, Execute “Hello welcome to java” program

Module : 3

Variables-Identifiers-Literals- Data types: Integer literals-character literals-Floating point literals- String Literals, Variables, Keywords, Data types.

Task: implementing data types with variables, find valid/invalid variables, Identifiers

Module : 4

Operators: Arithmetic operators, Relational operators, Assignment operators, Conditional operators, Type casting/Type Conversion in java.

Task: Perform all arithmetic operators using a single program, program using typecast/type conversion

Module : 5

Java Statements: Input and Output Statements, Accepting Input from the Keyboard, Displaying output with System.out.printf( ) , Displaying Formatted output with

String.format( )
Task: Write a program using I/O statements in java.

Module : 6
Control Structures: Conditional control statements :- if ..statement, if… else statement-if-else-if ladder, Switch statement
Task: Write a program to find a person is eligible for vote >18?, Largest number among 3 numbers?

Module : 7
Looping/Repetitive/Iterative statements: While statement- Do ..While statement-For Statement, Continue statement-Break statement.
Task: print N natural numbers, sum of N natural numbers, Armstrong number, Strong number using for statement.

Module:8
Arrays: Arrays, One-dimensional arrays, Creating an array, Find The Length Of An Array, Types of Arrays:-Two-dimensional arrays, Creating a two-dimensional array.
Task: Find the N^{th} Largest value in an array, Insert and Addition of values using array

Module : 9
Strings: Introduction to strings, Built in strings, Creating Strings, String reverse, String Concatenation, String comparison, Immutability of Strings
Task: write a program to Perform all string operations as single output

Module : 10
Classes , Objects& Methods: Introduction, Defining a class, Adding Variables, Object Creation, Initializing the Instance variables, Access Specifiers, Methods, Constructors, Method Overloading
Task: To implement Class and Object concept, Method Overloading program

Module :11
Interfaces: Interface, Multiple Inheritance using Interfaces.
Exception Handling: Errors in Java Program, Exceptions, throws clause, throw clause, Types of Exceptions,
Task: Implement a program using exception handling, write a program Multiple Inheritance using Interfaces.

Module : 12
Threads: Introduction, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, Life Cycle of a Thread. single Tasking Using a Thread, Multi tasking Using Threads
Task: Implement a program using Threads.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the basic concepts of OOP
- Compare & Contrast basic constructs of C++ & Java
- Develop a program on operators in Java
- Apply Control statements to solve real time problems
- Analyze the concepts of constructers, overloading, Inheritance and Interfaces in java
- Implementing different types of Threads to solve real time problems

Reference Books:

1. Programming with Java by E.Balagurusamy.
2. Programming in Java by Sachin Malhotra, OXFORD University Press.
3. Java Complete Reference by Herbert Schildt.
4. John R.Hubbard, Programming with Java, Second Edition, Schaum's outline series, TATA McGraw-Hill Company.

Web Reference:

1. https://www.javatpoint.com/java-tutorial
2. https://www.learnjavaonline.org/
3. https://www.tutorialspoint.com/java/index.htm
4. https://www.w3schools.com/java/
5. https://www.geeksforgeeks.org/java/

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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Environmental Science
Mandatory Course–I

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0027M	2: 0:0:0	0	CIE: 30 SEE:70	3Hours	MC

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generationsand pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

Syllabus	Total Hours:46
UNIT - I	8 Hrs

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT - II	12 Hrs

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity

– Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - III		8 Hrs

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT - IV		10 Hrs

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT - V		8 Hrs

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Course Outcomes (CO):

On completion of this course, student will be able to

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

Casus of population explosion, value education and welfare programmes.

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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Mechanical Engineering
II B.TECH.

Semester-IV (Theory–5, Lab–3,Skill course-1, Mandatory course-1)							
S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	22A0019T	Transforms and Probability distribution	BSC	2	1	0	3
2.	22A0312T	Applied Thermal Engineering	PCC	2	1	0	3
3.	22A0314T	Strength of Materials	PCC	2	1	0	3
4.	22A0316T	Fluid Mechanics and Hydraulic Machinery	PCC	2	1	0	3
5.	22A0021T	Universal Human Values	HSSC	3	0	0	3
6.	22A0315P	Strength of Materials Lab	PCC	0	0	3	1.5
7.	22A0317P	Fluid Mechanics and Hydraulic Machinery Lab	PCC	0	0	3	1.5
8	22A0313P	Applied Thermal Engineering Lab	PCC	0	0	3	1.5
9.	22A0517P	**Skill oriented course** Python Programming	SOC	1	0	2	2
10.	22A0029M	**Mandatory Non credit course–II** Constitution of India	MC	3	0	0	0
						Total	**21.5**
4 Weeks Community service Project is mandatory during Summer vacation							

Distribution of Credits among the Category of Courses		
S.No	Category of courses introduced	Credits Assigned
1	Basic Science Courses (1T)	3
2	Professional Core Courses (3T+3L)	13.5
3	Humanities and Social Science Courses (1T)	3
4	Skill Oriented Course – 1 (T+P)	2
5	Mandatory Non Credit Course (1T)	0
Total Credits		21.5

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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Transforms & Probability Distributions (Common to EEE , ME)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0019T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**BSC**

Course Objectives:

- Our emphasis will be more on conceptual understanding and application of Fourier series,Fourier, Z and Laplace transforms and random variables and probability distributions.

Syllabus		**Total Hours:45**
Module - I	**Laplace Transforms**	**9 Hrs**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform– First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shiftingtheorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.

Differentiation and integration of transform – Application of Laplace transforms to ordinary differentialequations of first and second order.

Module - II	**Fourier series**	**9 Hrs**

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions-Parseval's formula- Complex form of Fourier series.

Module - III	**Fourier transforms**	**9 Hrs**

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inversetransforms – convolution theorem.

Module - IV	**Z Transforms**	**9 Hrs**

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and finalvalue theorems. Convolution theorem – Solution of difference equations by z-transforms.

Module - V	**Random Variables & Probability Distributions**	**9 Hrs**

Random variables (discrete and continuous), Probability density functions, properties Discrete distribution: Binomial, Poisson approximation to the binomial distribution and their properties.Continuous distribution: Normal distribution and their properties.

Course Outcomes (CO):

Student will be able to

- Understand the concept of Laplace transforms, find the Laplace transforms of differentfunctions and apply Laplace transforms to solve Differential Equations.
- Find the Fourier series expression for the different periodic functions.
- Find Fourier Sine and cosine integrals. Understand Fourier transforms. Apply propertiesof Fourier transforms.
- Understand Z transforms, apply Z transforms, to solve difference equations.
- Explain the notion of random variable, distribution functions, apply Binomial,Poisson distribution and normal distributions for real data to compute probabilities.

Text Books:

1. B.S.Grewal , "Higher Engineering Mathematics", Khanna publishers.
2. Mathematics II by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
3. Probability & Statistics by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.

Reference Books:

1. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
3. Mathematical Foundations of Statistics by K. C. Kapoor & Gupta, S. Chand Publications.

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Applied Thermal Engineering					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0311T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To introduce students to the Working Principles of IC engines.
- To teach combustion process in SI and CI engines.
- To impart knowledge on different types of compressors.
- To familiarize concepts of thermodynamic cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.

Syllabus		**Total Hours:42**
UNIT - I	**IC Engines**	**10 Hrs**

Working and classification of IC engines, comparison of two stroke and four stroke engines, comparisonof SI and CI Engines.

Combustion in IC Engines: SI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting ignition lag, Flame propagation and knocking. CI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking.

Testing and Performance of IC Engines: Methods of testing IC Engines, performance analysis of ICEngines.

UNIT - II	**Air compressors**	**8 Hrs**

Reciprocating Compressor: Single stage reciprocating compressors, work required, effect of clearance in compressors, volumetric efficiency, multi stage compressor, effect of inter cooling in multi stage compressors, compressor performance.

Rotary Compressor: Working principle of a rolling piston type compressor (fixed vane type), multi vane type compressors, characteristics of rotary vane type compressor, working principle of centrifugal and axial flow compressors.

UNIT - III	**Vapour & Gas Power Cycles**	**8 Hrs**

Vapour power cycle, simple Rankine cycle, mean temp of heat addition, thermodynamic variableseffecting efficiency, Rankine cycle – reheating and regeneration.

Simple gas turbine plant, Brayton cycle, closed cycle and open cycle for gas turbines, condition for optimum pressure ratio, actual cycle. Methods to improve performance: regeneration, intercooling and reheating.

UNIT - IV	Nozzles & Steam Turbines	8 Hrs

Type of nozzles - gas and steam nozzles. Compressible flow through nozzle- condition for maximumdischarge - Nozzle efficiency - Super saturation.

Steam Turbines - impulse turbine and reaction turbine – compounding of impulse turbines - velocitydiagrams in impulse and reaction turbines, blade efficiency, degree of reaction.

UNIT - V	Refrigeration & Air-Conditioning	8 Hrs

Refrigeration: Bell-Coleman cycle - vapour compression cycle, sub cooling and super heating-vapourabsorption cycle, properties of common refrigerants.

Principles of Psychrometry and Air Conditioning: Psychometric properties, psychometric processes,summer and winter air conditioning systems.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the working of IC engines with combustion process. (L1)
- Select compressors for different applications. (L2)
- Use T-s diagram in vapour power and gas power cycles. (L3)
- Evaluate the relative performance of different steam turbines (L6)
- Select appropriate refrigerant for different applications. (L6)

Textbooks:

1. Mahesh V Rathore, Thermal Engineering, Tata McGraw Hill 2017
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014

Reference Books:

1. Ganesan V, Internal Combustion Engines, Tata McGraw Hill, 2017.
2. Yahya, S. M., Turbines, Compressors and Fans, 4/e, Tata McGraw Hill, 2010.
3. Nag P.K, Engineering Thermodynamics, 4/e, Tata McGraw-Hill, 2008.
4. Onkar Singh, Thermal Turbomachines, 3/e, Wiley India, 2014.
5. C.P.Arora, Refrigeration and Air Conditioning, Tata McGraw-Hill, 2000

Web links:

1. https://nptel.ac.in/courses/112/103/112103307/
2. https://nptel.ac.in/courses/112/103/112103275/

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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Strength of Materials					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0313T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- Understand the basics of stresses and strains
- Draw the shear force and bending moment drawings of various beams.
- Understand the Behaviour of members and Torsional forces
- Understand the Behaviour of cylinders
- Understand the stresses developing in curved beams.

Syllabus		**Total Hours:42**
UNIT - I	**Analysis of stress and strain**	**10 Hrs**

Types of external loads - self weight - internal stresses - normal and shear stresses - strain - Hooke's law - Poisson's ratio - relationship between elastic constants - stress strain diagrams working stress - elongation of bars of constant and varying sections - Stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette – principal stress/strain problem as an eigen value problem.

UNIT - II	**Bending moment and shear force**	**8 Hrs**

Different types of beams - shear force and bending moment diagrams for simply supported, overhanging and cantilever beams - relationship connecting intensity of loading, shearing force and bending moment - shear force and bending moment diagrams for statically determinate plane frames.

UNIT - III	**Torsion and Springs**	**8 Hrs**

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT - IV	**Thin Cylinders, Spheres and Thick Cylinders**	**8 Hrs**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame"s theory – Application of theories of failure.

UNIT - V	**Bending of curved bars & Unsymmetrical Bending**	**8 Hrs**

Stresses in bars of small initial curvature, Winkler-Bach theory, Stresses in bars of large initial curvature, Deflection of Crane hooks, Chain links, circular rings, stresses in circular rings.

Introduction to unsymmetrical bending, Stresses and deflection in unsymmetrical bending, Shear center for angle, Channel and I-sections.

Course Outcomes (CO):

On completion of this course, student will be able to

- Evaluate stresses and strains
- To draw the SF and BM diagrams for various beams under different loading conditions
- Determine the resistance and deformation in machine members subjected to torsional loads and springs.
- Analyze and design thin, thick cylinders.
- Analysis of stresses in curved bars.

Textbooks:

1. J. M. Gere and S. P. Timoshenko, Mechanics of Material, CBS publisher, 2018
2. Popov, E.P., Mechanics of Materials, Prentice Hall India, New Delhi, 2002.

Reference Books:

1. Advanced Mechanics of Materials–A. P. Boresi and O. M. Sidebottom–John Wiley & Sons
2. Strength of Materials – R. K. Rajput – S. Chand & Company
3. Beer, F.P.,Johnston, E.R. and DeWolf, J.T.,Mechanics of Materials, 3rd ed., Tata McGraw-Hill
4. Strength of Material – Dr. Sadhu Singh – Khanna Publishers
5. Strength of Material, Vol. I and II – S. P. Timoshenko – EWP Press

Web links:

1. https://nptel.ac.in/courses/112/107/112107146/
2. https://ocw.mit.edu/courses/materials-science-and-engineering/3-11-mechanics-of-materials-fall-1999/
3. https://www.coursera.org/courses?query=mechanics%20of%20materials
4. https://www.udemy.com/course/strengthofmaterials/

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Fluid Mechanics and Hydraulic Machinery					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0315T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To impart ability to solve engineering problems in fluid mechanics
- To explain basics of statics, kinematics and dynamics of fluids and various measuring techniques of hydrostatic forces on objects.
- To enable the students measure quantities of fluid flowing in pipes.
- To impart knowledge on design of turbines and pumps.

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to Fluid Statics**	**10 Hrs**

Distinction between a fluid and a solid - characteristics of fluids - Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces.

UNIT - II	**Fluid kinematics and Dynamics**	**8 Hrs**

Classification of fluid flow - Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three - dimensional continuity equations in Cartesiancoordinates.

Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: Venturimeter, Orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced.

UNIT - III	**Analysis of Pipe Flow**	**8 Hrs**

Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length – Pipes in Parallel and Series. Laminar Flow- Laminar flow through: circular pipes. Stoke's law, Measurement of viscosity. Reynolds experiment, Transition from laminar to turbulent flow. Resistance to flow of fluid in smooth and rough pipes-Moody's diagram.

UNIT - IV	**Hydraulic Turbines**	**8 Hrs**

Impact of Jets- Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes -velocity triangles at inlet and outlet - Work done and efficiency - Hydraulic Turbines: Classification of turbines; pelton wheel and its design. Francis turbine and its design - efficiency - Draft tube: theory- characteristic curves of hydraulic turbines

UNIT - V	**Hydraulic Pump**	**8 Hrs**

Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; limitation of suction lift, net positive suction head (NPSH); Performance and characteristic curves; Multistage centrifugal

pumps; troubles and remedies – Introduction to Reciprocating Pump- Cavitation - Cavitation effects;

Course Outcomes (CO):

On completion of this course, student will be able to

- Familiarize basic terms used in fluid mechanics.
- Understand the principles of fluid statics, kinematics and dynamics.
- Understand flow characteristics and classify the flows and estimate various losses in flow through pipes.
- Design of different types of turbines.
- Design of different types of centrifugal and multistage pumps.

Textbooks:

1. P. M. Modi and S. M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House
2. K. Subrahmanya, "Theory and Applications of Fluid Mechanics", Tata McGraw Hill

Reference Books:

1. R. K. Bansal, A text of "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi.
2. K. Subramanya, Open channel Flow, Tata McGraw Hill.
3. N. Narayana Pillai, Principles of "Fluid Mechanics and Fluid Machines", Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.
4. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, "Fluid Mechanics and Machinery", Oxford University Press, 2010.
5. Banga& Sharma, "Hydraulic Machines", Khanna Publishers.

Web links:

1. https://www.coursera.org/courses?query=fluid%20mechanics
2. https://www.udemy.com/topic/fluid-mechanics/
3. https://onlinecourses.nptel.ac.in/noc21_ce31/preview
4. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii- iv-fall-2005-spring-2006/fluid-mechanics/
5. http://lms.msitonline.org/mod/folder/view.php?id=138

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Universal Human Values
(Common to all branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0021T	3: 0:0:0	3	CIE: 30 SEE:70	3Hours	HSSC

Course Objectives:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society andnature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Syllabus		**Total Hours:48**
Module-I	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**	**10 Hrs**

Purpose and motivation for the course, recapitulation from Universal Human Values-I
Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
Continuous Happiness and Prosperity- A look at basic Human Aspirations
Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module-II	**Understanding Harmony in the Human Being - Harmony in Myself!**	**9 Hrs**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of 'I' and harmony in 'I'
Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module-III	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship	10 Hrs

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

Understanding the meaning of Trust; Difference between intention and competence

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module-IV	Understanding the Nature and Existence hole existence as Coexis	9 Hrs

Understanding the harmony in the Nature

Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature

Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can beused), pollution, depletion of resources and role of technology etc.

Module-V	Implications of the above Holistic Understanding of Harmony on Professional Ethics	10 Hrs

Natural acceptance of human values

Definitiveness of Ethical Huma

Conduct

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco- friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systemsStrategy for transition from the present state to Universal Human Order:

a. At the level of individual: as socially and ecologically responsible engineers, technologists andmanagers

b. At the level of society: as mutually enriching institutions and organizationsSum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. Todiscuss the conduct as an engineer or scientist etc.

Course Outcomes (CO):

On completion of this course, student will be able to

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Textbooks:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd
2. Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
3. 3. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values andProfessional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.The Story of Stuff (Book).
3. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
4. E. FSchumacher. "Small is Beautiful"Slow is Beautiful –Cecile Andrews
5. J C Kumarappa "Economy of Permanence" Pandit Sunderlal "Bharat Mein Angreji Raj" Dharampal, "Rediscovering India"
6. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"India Wins Freedom - Maulana Abdul Kalam Azad Vivekananda - Romain Rolland(English)
7. Gandhi - Romain Rolland (English)

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Strength of Materials Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0314P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- By performing this laboratory, the student will be able to know the structural behavior ofvarious materials

Syllabus — **Total Hours:45**

1. Tension test.
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simply supported beam.
4. Torsion test.
5. Vickers Hardness Test
6. Rockwell Hardness Test
7. Brinell Hardness Test
8. Compression test on Open coiled springs
9. Tension test on Closely coiled springs
10. Compression test on wood/ concrete
11. Izod Impact test on metals
12. Charpy Impact test on metals
13. Continuous beam – deflection test.

Note : Any 12 of the above equipments

Course Outcomes (CO):

On completion of this course, student will be able to

- By performing the various tests in this laboratory the student will be able to know the structural behavior of various structural elements when subjected to external loads

Reference Books:

1. Strength of Materials Lab Manual by Anand Jayakumar A , Notion Press

Web links:

1. http://sm-nitk.vlabs.ac.in/#

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Fluid Mechanics and Hydraulic Machinery Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0309P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- By performing this laboratory, the student will be able to know the fluid flow measurements by considering different types flow measurement devices and working principles of various pumps and motors.

Syllabus — **Total Hours:45**

1. Verification of Bernoulli's equation.
2. Calibration of Venturi meter.
3. Calibration of Orifice meter
4. Determination of Coefficient of discharge for a small orifice by constant head method.
5. Determination of Coefficient of discharge for a small orifice by variable head method.
6. Determination of Coefficient of discharge for an external mouth piece by Constant headmethod.
7. Determination of Coefficient of discharge for an external mouth piece by variable headmethod.
8. Calibration of contracted Rectangular Notch.
9. Calibration of contracted Triangular Notch. Determination of friction factor
10. Determination of loss of head in a sudden contraction.
11. Determination of loss of head in a sudden Expansion.
12. Performance test on Impulse turbines
13. Performance test on reaction turbines (Francis and Kaplan Turbines)
14. Impact of jet
15. Performance test on centrifugal pumps, determination of operating point and efficiency

Course Outcomes (CO):

On completion of this course, student will be able to

- By performing the various tests in this laboratory the student will be able to know the principles of discharge measuring devices and head loss due to sudden contraction and expansion in pipes and working principles of various pumps and motors.

Reference Books:

1. Fluid Mechanics & Hydraulic Machines A Lab Manual by Ts Desmukh (Author), Laxmi Publications (P) Ltd
2. Fluid Mechanics & Machinery Laboratory Manual by N Kumara Swamy (Author), Charotar Books Distributors
3. Lab. Manual of Fluid Mechanics & Machines by Gupta, Chandra (Author), cbspd (Publisher)

Web links:

1. **http://eerc03-iiith.vlabs.ac.in/**

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Applied Thermal Engineering Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0312P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- Understand the functioning and performance of I.C. Engines.
- To find heat losses in various engines.

Syllabus — **Total Hours:45**

1. Valve timing diagram of 4 – stroke diesel engine.
2. Port timing diagram of 2 – stroke petrol engine.
3. Assembly and disassembly of petrol and diesel engines.
4. Performance of 2 – stroke single cylinder petrol engine.
5. Performance of 4 – stroke single cylinder diesel engine.
6. Morse test on multi cylinder petrol engine.
7. Performance of two stage reciprocating air compressor.
8. Performance of heat pump.
9. Performance of Refrigeration system.
10. Performance of Air conditioning system.
11. Determination of nozzle characteristics.
12. Exhaust gas analysis.

Note : Any 10 of the above experiments

Course Outcomes (CO):

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

- Explain different working cycles of engine.
- Describe various types of combustion chambers in I.C. Engines.
- Evaluate heat balance sheet of I.C. Engine.
- Illustrate the working of refrigeration and air conditioning systems.

Reference Books:

1. Abdul Matheen, Heat Transfer Laboratory Manual, Laxmi Publications; 2/e, 2007.

Online Learning Resources/Virtual Labs:

1. https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab
2. https://www.iare.ac.in/sites/default/files/lab1/IARE_HT_LAB_MANUAL.pdf
3. https://mrcet.com/downloads/digital_notes/ME/III%20year/(R18A0388)Heat%20Transfer%20Lab.pdf
4. https://mrcet.com/downloads/ME/Mech%20III-II.pdf

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Python Programming					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0517P	**1: 0:2:0**	**2**	**CIE: 30 SEE:70**	**3Hours**	**SOC**

Course Objectives:

- Acquire programming skills in core Python
- To understand the importance of Object-oriented Programming
- Develop the skill of designing graphical-user interfaces (GUI) in Python.
- Develop the ability to write database applications in Python.

Syllabus | **Total Hours: 36**

Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements

Python Data Structures: Lists, Dictionaries, Tuples.

Strings: Creating strings and basic operations on strings, string testing methods.

Functions: Defining a function- Calling a function- Types of functions-Function Arguments-Anonymous functions- Global and local variables

OOPS Concepts; Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

Modules and Packages: Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modulesand external packages

Working with Data in Python: Printing on screen- Reading data from keyboard- Opening and closingfile- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:

1. OPERATORS

a. Read a list of numbers and write a program to check whether a particular element is present or notusing membership operators.

b. Read your name and age and write a program to display the year in which you will turn 100 yearsold.

c. Read radius and height of a cone and write a program to find the volume of a cone.

d. Write a program to compute distance between two points taking input from the user (Hint: usePythagorean theorem)

2. CONTROL STRUCTURES

a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if…elif…else statement.

b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.

c. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +…….+ n/n!. (Input :n = 5, Output : 2.70833)

d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

3: LIST

a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).

b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10,15, 14, 63], odd numbers sum = 101, even numbers sum = 24)

c. Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84,96], The numbers in odd index position: 25 47 84).

d. Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicateelements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

4: TUPLE

a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from alist of tuples. test_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]

b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test_list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”,), (“Gfg”, “CS”)],Output : [(„GFG“, „IS“, „BEST“)]).

c. Given a tuple and a list as input, write a program to count the occurrences of all items of the list inthe tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

5: SET

a. Write a program to generate and print a dictionary that contains a number (between 1 and n) in theform (x, x*x).

b. Write a program to perform union, intersection and difference using Set A and Set B.

c. Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output:No. of vowels : 3)

d. Write a program to form concatenated string by taking uncommon characters from two strings usingset concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

6: DICTIONARY

a. Write a program to do the following operations:

i. Create a empty dictionary with dict() method

ii. Add elements one at a time

iii. Update existing key“s value

iv. Access an element using a key and also get() method

v. Deleting a key value using del() method

b. Write a program to create a dictionary and apply the following methods:
i. pop() method
ii. popitem() method
iii. clear() method
c. Given a dictionary, write a program to find the sum of all items in the dictionary.
d. Write a program to merge two dictionaries using update() method.

7: STRINGS

a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A stringis said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
b. Write a program to read a string and count the number of vowel letters and print all letters except 'e'and 's'.
c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split()method, Input : India is my country. Output : is my country)
d. Write a program to read a string and count how many times each letter appears. (Histogram).

8: USER DEFINED FUNCTIONS

a. A generator is a function that produces a sequence of results instead of a single value. Write agenerator function for Fibonacci numbers up to n.
b. Write a function merge_dict(dict1, dict2) to merge two Python dictionaries.
c. Write a fact() function to compute the factorial of a given positive number.
d. Given a list of n elements, write a linear_search() function to search a given element x in a list.

9: BUILT-IN FUNCTIONS

a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(),median() by importing statistics library.
b. Write a program to demonstrate the working of built-in trignometric functions sin(), cos(), tan(),hypot(), degrees(), radians() by importing math module.
c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(),log(), log2(), log10(), pow() by importing math module.
d. Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(),factorial(), gcd() by importing math module.

10. CLASS AND OBJECTS

a. Write a program to create a BankAccount class. Your class should support the following methodsfor

i) Deposit
ii) Withdraw
iii) GetBalanace
iv) PinChange

b. Create a Savings Account class that behaves just like a Bank Account, but also has an interest rateand a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).

c. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info() method and also using dictionary (_dict_).

d. Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

11. FILE HANDLING

a. . Write a program to read a filename from the user, open the file (say firstFile.txt) and then performthe following operations:

i. Count the sentences in the file.

ii. Count the words in the file.

iii. Count the characters in the file.

b. . Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file shouldstore only lower case alphabets and display the number of lines copied.

c..Write a Python program to store N student's records containing name, roll number and branch. Printthe given branch student's details only.

Course Outcomes (CO):

Students should be able to

- Understand various data types like lists, tuples, strings etc
- Able to create practical and contemporary applications using Functions
- Explore the use of Object oriented concepts to solve Real-life problems
- Utilize Python packages in developing software applications
- Solve mathematical problems using Python programming language

References:

1. Reema Thareja, "Python Programming - Using Problem Solving Approach", Oxford Press, 1st Edition, 2017.
2. Michael H Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007.
3. Yashavant Kanetkar, Aditya Kanetkar, "Let us Python", BPB publication, 1st Edition, 2019.
4. Ashok Kamthane, Amit Kamthane, "Programming and Problem Solving with Python", McGraw Hill Education (India) Private Limited, 2018.
5. Taneja Sheetal, Kumar Naveen, "Python Programming – A modular approach", Pearson, 2017

Web References:

1. https://realpython.com/python3-object-oriented-programming/
2. https://python.swaroopch.com/oop.html
3. https://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
4. https://www.programiz.com/python-programming/
5. https://www.geeksforgeeks.org/python-programming-language/

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Constitution of India
Mandatory Non credit course–II

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0029M	3: 0:0:0	0	CIE: 30 SEE:70	3Hours	MC

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

Syllabus		**Total Hours:48**
Module-I	**Introduction to Indian Constitution**	**10 Hrs**

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Module-II	Union Government and its Administration Structure of the Indian Union	**9 Hrs**

Union Government and its Administration Structure of the Indian Union - Federalism – Centre State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Module-III	**State Government and its Administration**	**10 Hrs**

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions.

Module-IV	**Local Administration**	**10 Hrs**

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Pachayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO,Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Module-V	**Election Commission**	**9 Hrs**

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

Textbooks:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, "Indian Constitution", National Book Trust 3. R R Gaur, R Asthana, G P

Reference Books:

1. H.M.Sreevai, "Constitutional Law of India", 4th edition in 3 volumes
2. J.A. Siwach, "Dynamics of Indian Government & Politics"
3. M.V. Pylee, "Indian Constitution", Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
4. J.C. Johri, Indian Government and Politics Hans
5. M.V. Pylee, "Indian Constitution)

E-Resources:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture- details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

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Mechanical Engineering
III B.TECH.

Semester-V (Theory–5, Lab–3, Mandatory Course-1)							
S.No	**Course Code**	**Course Name**	**Category**	**Hours per week**			**Credits**
				L	**T**	**P**	
1.	22A0318T	Kinematics of Machinery	PCC	2	1	0	3
2.	22A0319T	Machine Tools and Metrology	PCC	3	0	0	3
3.	22A0321T	CAD/CAM	PCC	3	0	0	3
4.	22A0323T	**Professional Elective Course -I**	PEC	3	0	0	3
	22A0323Ta	Automobile Engineering					
	22A0323Tb	Mechanical Vibrations					
	22A0323Tc	Automation In Manufacturing					
5.		**Open Elective Course -I**	OEC	3	0	0	3
	22A0149T	Building Materials					
	22A0430T	Principles of Communications					
	22A0214Ta	Power Electronics					
	22A0512T	Data Base Management System					
6.	22A0320P	Machine Tools and Metrology Lab	PCC	0	0	3	1.5
7.	22A0322P	CAD/CAM/CAE lab	PCC	0	0	3	1.5
8.	22A0029P	**Skill oriented course** Soft Skills	SOC	1	0	2	2
9.	22A00526T	**Mandatory Course** Design Thinking for Innovation	MC	2	0	0	0
10	22A0324	**Internship-I((**Evaluated the community service project completed at the end of second year)					1.5
						Total	**21.5**

Distribution of Credits among the Category of Courses		
S.No	Category of Courses Introduced	Credits Assigned
1	Professional Core Courses (3T+2L)	12
2	Professional Elective Courses (1T)	3
3	Humanities and Social Science Courses (1T)	3
4	Skill Oriented Course – 1 (T+P)	2
5	Mandatory Non Credit Course (1T)	0
6	Community Service Project completed in Second year	1.5
	Total Credits	21.5

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Kinematics of Machinery					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0317T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- The Objectives of this course are to:
- To provide a foundation for the study of Dynamics of Machinery and machine design.
- Comprehend the fundamentals of kinematics and to understand the concept of machines, mechanisms and related terminologies.
- Analyze a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To develop skills for designing and analyzing linkages and mechanisms.
- Formulate the concept of synthesis and analysis of different mechanisms.
- To understand the Principles and working of various straight line motion mechanisms.
- To analyze Steering gear mechanisms and working of Hooke's joint.
- To understand the theory of gears, gear trains and cams.

Syllabus		**Total Hours:42**
UNIT - I	**MECHANISMS AND MACHINES**	**8 Hrs**

Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain, single and double slider crank chain. Mobility of mechanisms.

UNIT - II	**Steering & Straight-Line Motion Mechanisms**	**8 Hrs**

Straight Line Motion Mechanisms- Exact and approximate, copied and generated types – Peaucellier, Hart, Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint — applications – Simple problems

UNIT - III	**KINEMATICS**	**10 Hrs**

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, determination of Coriolis component of acceleration, Klein's construction: Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method.

Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centers in-line theorem – Locating instantaneous canters for simple mechanisms and determination of angular velocity of points and links.

UNIT - IV	Gears & GEAR TRAINS	10 Hrs

GEARS: Higher pairs, toothed gears – types – law of gearing, condition for constant velocity Ratio for transmission of motion, Forms of tooth- cycloidal and involute profiles. Velocity of sliding – phenomena of interference – Methods to avoid interference - Condition for minimum number of teeth, expressions for arc of contact and path of contact. Introduction to Helical, Bevel and Worm gears

GEAR TRAINS:

Introduction –Types of gears – Simple, Compound, Reverted and Epicyclic gear trains, Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains. Differential gear of an automobile – Simple problems

UNIT - V	CAMS & Followers	10 Hrs

CAMS: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity, Simple harmonic motion, Cycloidal, uniform acceleration and retardation, Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

ANALYSIS OF MOTION OF FOLLOWERS: Tangent cam with roller follower – circular arc (Convex) cam with flat faced and roller follower

Course Outcomes (CO):

- Build up critical thinking and problem-solving capacity of various mechanical engineering problems related to kinematics of machines (L4)
- Understand the basic principles of mechanisms in mechanical engineering (L1)
- Assess various concepts of mechanisms like straight line motion mechanisms, Steering gear mechanisms and working principles of power elements (Gears, gear trains, Cams) and design related problems effectively (L6)
- Examine the velocity and acceleration diagram for a given mechanism (L3)
- Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective design (L3)
- Construct the cam profile for a given motion (L3)
- Analyze various gear trains (L4)

Textbooks:

1. Theory of Machines and Mechanisms-S.S.Rattan, Tata McGraw Hill Publishers.
2. Theory of Machines R.S Khurmi& J.K Gupta, S Chand Publishers.

Reference Books:

1. Theory of Machines by Thomas Bevan/ CBS
2. Theory of Machines / R.K Bansal
3. Theory of Machines Sadhu Singh PearsonsEdn
4. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
5. The theory of Machines /Shiegley/ Oxford.
6. Theory of machines – PL. Balaney/khanna publishers

Web links:

1. https://www.digimat.in/nptel/courses/video/112104121/L01.html
2. https://nptel.ac.in/courses/112/105/112105268/

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Machine Tools and Metrology					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0318T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

At the end of this unit, the student will be able to

- Describe the mechanism of metal cutting
- Explain the working of various lathe machines
- Explain working of shaper, slotter and planer

Syllabus		**Total Hours:42**
UNIT - I	**Fundamentals of Machining**	**10 Hrs**

Fundamentals of Machining: Introduction, mechanics of cutting, geometry of single point cutting tool, types of chips produced in metal cutting, chip breakers, orthogonal cutting and oblique cutting, cutting Forces-Merchants circle, power estimation and temperatures generated in cutting, tool life, tool wear, machinability, cutting tool materials, cutting fluids-functions, types

UNIT - II	**Lathe**	**10 Hrs**

Principle of Lathe, types of lathes, lathe components, specifications, tool and work holding devices, Lathe operations, material removal rate, machining time. Turret and capstan lathes: collet chucks, tool holding devices, tool layout, principal features of automatic lathes, classification, single spindle and multi-spindle automatic lathes.

UNIT - III	**Shaping, Slotting and Planning**	**10 Hrs**

Shaping, Slotting and Planning: Principle of working, classification, specifications, operations performed, machining time calculations. Drilling and Boring: Principle of working, types, and operations performed, specifications tool holding devices, twist drill, Jig boring.

UNIT - IV	**Linear Measurements**	**10 Hrs**

Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement .Linear Measuring Instruments — Evolution — Types — Classification — Limit gauges — gauge design — terminology — procedure — concepts of interchange ability and selective assembly

UNIT - V	**Angular Measurements**	**10 Hrs**

Angular measuring instruments — Types — Bevel protractor clinometers angle gauges, spirit levels sine bar — Angle alignment telescope — Autocollimator — Applications.

Course Outcomes (CO):

- Explain metal cutting principles
- Describe the details and operations on lathe
- Discuss shaping, slotting, planning, drilling and boring operations
- Explain the details and operations on milling machine
- Differentiate among various finishing operations

Textbooks:

1. Ghosh Amitabha, A. K. Mallik, Manufacturing Science, 2nd Edition, Affiliated East-West Press, 2010. (for Unit-I)
2. P. N. Rao, Manufacturing Technology Volume 2: Metal Cutting and Machine Tools, 3rd Edition, McGraw Hill, 2013. (for Unit-II to Unit-V)
3. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication (KATSON).
4. Mechanical Measurement and Metrology by R K Jain, Khanna Publisher Mechanical Measurement & Control by D.S. Kumar

Reference Books:

1. Kalpak Jian and S R Schmid, Manufacturing Engineering and Technology, 5th Edition, Pearson, 2006.
2. R.K. Jain and S.C. Gupta, Production Technology, 16th Edition, Khanna Publishers, 2001
3. Industrial Instrumentation & Control by S K Singh, McGraw-Hill
4. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press

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CAD/CAM					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0323T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

Understand the basics of CAD/CAM, geometric representation, transformations.

1. Explain geometric modeling methods in CAD.
2. Familiarize numerical control (NC), computer numerical control (CNC) and direct numerical control (DNC) machines.
3. Impart knowledge on manual part programming and computer aided part programming.
4. Explain the principles robotics, CIM, AR,VR and AI in CIM

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to CAD/CAM**	**12 Hrs**

CAD/CAM: Introduction, hardware and software, I/O devices, benefits. Graphics standards-Neutral file formats – IGES, STEP.

2D and 3D geometric transformations: Translation, scaling, rotation, mirroring, homogenous transformations, concatenation of transformations, viewing transformations

UNIT - II	**Geometric Modelling**	**10 Hrs**

Parametric representation: Representation of curves, Hermite curves, Spline, Bezier and B-spline curves in two dimensions; Geometric modelling of surfaces: Surface patch, Coons and bicubic patches, Bezier and B-spline surfaces, sweep surfaces, surface of revolution, blending of surfaces

Geometric Modelling of Solids: Wireframe, surface modelling, solid entities, Boolean operations, CSG approach and B-rep of solid modelling, geometric modelling of surfaces.

UNIT - III	**Computer Aided Manufacturing (CAM)**	**10 Hrs**

Computer Aided Manufacturing (CAM): Structure of numerical control (NC) machine tools, designation of axes, drives and actuation systems, feedback devices, computer numerical control (CNC) and direct numerical control (DNC), adaptive control system, CNC tooling, automatic tool changers and work holding devices, functions of CNC and DNC systems.

UNIT - IV	**Part Programming and APT Programming**	**12 Hrs**

Part Programming: Part programming instruction formats, information codes, preparatory functions, miscellaneous functions (G-codes, M-codes). Tool codes and tool length offset, interpolations canned cycles.

APT Programming: APT language structure, APT geometry, Definition of point, line, circle, plane.

APT Motion Commands: set-up commands, pint to point motion commands; continuous path motion commands part programming preparation for typical examples (milling and turning operation)

UNIT - V	Automation	12 Hrs

Automation: Anatomy and configuration of robot, characteristics of robots, grippers, application of robots in manufacturing, robot programming languages, Group Technology, Introduction to computer integrated manufacturing, Introduction to Virtual Reality (VR), Augmented Reality (AR) and Artificial Intelligence (AI).

Course Outcomes (CO):

- Explain geometric modeling methods in CAD.
- Familiarize numerical control (NC), computer numerical control (CNC) and direct numerical control (DNC) machines.
- Impart knowledge on manual part programming and computer aided part programming.
- Explain the principles robotics, CIM, AR,VR and AI in CIM

Textbooks:

1. P. N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017.
2. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, 2/e, Tata McGraw-Hill, Delhi, 2009.

Reference Books:

1. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008.
2. P. Radhakrishnan, S. Subramanyan& V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008.
3. Computer Aided Manufacturing, 3/e, Tien Chien Chang, Pearson, 2008.

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Automobile Engineering					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0321Ta	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

Impart the knowledge of vehicle structure and its components.

- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to vehicle structure and engine components**	**12 Hrs**

Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters. Crankcase ventilation

UNIT - II	**Ignition and fuel supply systems**	**10 Hrs**

Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit Injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI.

UNIT - III	**Steering and suspension system**	**10 Hrs**

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

UNIT - IV	**Wheels, Tyres and Braking System**	**12 Hrs**

Wheels and Tyres - Construction - Type and specification - Tyre wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS).

UNIT - V	**Automobile electrical systems and advances in automobile engineering**	**12 Hrs**

Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP), Traction Control System (TCS) - Global Positioning System (GPS), Hybrid vehicle, Fuel Cell.

Course Outcomes (CO):

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

- Identify different parts of automobile
- Explain the working of various parts like engine and brakes
- Describe the working of steering and the suspension systems.
- Summarize the wheels and tires
- Outline the future developments in the automobile industry

Textbooks:

1. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications, 13/e, 2020.
2. William.H.Crouse, Automotive Mechanics, 10/e , McGraw-Hill, 2006.
3. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, 2009.
4. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International, 2004.

Reference Books:

1. Bosch, Automotive Hand Book, 6/e, SAE Publications, 2007.
2. K. Newton and W. Steeds, The motor vehicle, 13/e, Butterworth-Heinemann Publishing Ltd, 1989.
3. Joseph Heitner, Automotive Mechanics Principles and Practices, 2/e, CBS publishing 2004

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Mechanical Vibrations					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0321Tb	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- Demonstrate basic concepts and definitions of mechanical vibrations. To write equation of motion for discrete spring-mass systems with different configuration using classical and energy methods.
- To train the students about basic concepts of forced vibrations, vibration transmissibility and isolation and seismic instruments. Further to understand about various vibration control methods.
- To familiarize the students about two degree freedom system and various types of vibration absorbers.
- To analyze the two degree and multi degree of freedom systems.

Syllabus		**Total Hours:42**
UNIT - I	**Single Degree Freedom Systems**	**12 Hrs**

Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient. Simple problems.

Whirling of shafts: Transverse vibrations: Dunkerley's lower bound approximation, Critical speed of shafts.

UNIT - II	**Forced vibrations of Single Degree Freedom Systems**	**10 Hrs**

Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping

UNIT - III	**Two Degree Freedom Systems**	**10 Hrs**

Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber

UNIT - IV	**Multi Degree Freedom Systems:**	**12 Hrs**

Lagrangian method for formulation of equation of motion Influence co- efficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of free and forced vibrations

UNIT - V	**Vibration measurement and Applications**	**12 Hrs**

Transducers: variable resistance transducers, Piezoelectric transducers, electro dynamic transducers and linear variable differential transformer transducer; Vibration pickups: vibrometer, accelerometer, velometer and phase distortion; Frequency-measuring instruments; Vibration exciters- Mechanical exciters and electro dynamic shaker.

Textbooks:

1. Singiresu S. Rao, Mechanical Vibrations, 6/e, Pearson Education, 2018.
2. G.K.Groover, Mechanical Vibrations, Nemchand& Bro, 8/e, 2009.

Reference Books:

1. L. Meirovich, Elements of Vibrations Analysis, Tata McGraw Hill, 1986.
2. S. Graham Kelly, Mechanical Vibrations, Tata McGraw Hill, 1996
3. William Thomson, Theory of Vibrations with Applications, 5/e, Pearson, 2008
4. William Weaver, Timeoshenko, and Young, Vibration Problems in Engineering, 5/e, John Wiley, 2013.

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Automation In Manufacturing					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0321Tc	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To introduce various strategies of automation in manufacturing.

Syllabus		**Total Hours:42**
Module 1:	**Introduction and Automated Flow Lines**	**12 Hrs**

Introduction: Production system – automation in production system – elements of automated system – levels of automation - types of automation – automation principles and strategies.
Automated Flow Lines: Configurations of AFL - methods of part transport - transfer mechanism - buffer storage – system design considerations

Module 2:	**Analysis of Automated Flow Lines, Assembly system and Line Balancing**	**10 Hrs**

Analysis of Automated Flow Lines: General terminology and analysis of transfer lines without buffer storage – upper bound approach and lower bound approach - analysis of automated flow lines with buffer storage – analysis of two stage transfer line – analysis of more than two stages - partial automation – analysis – cost calculations.
Assembly system and Line Balancing: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance.

Module 3	**Automated Material Handling**	**10 Hrs**

Automated Material Handling: Introduction – Design considerations in material handling - Types of equipment - material transport equipment – AGVS – conveyors – hoists and cranes - analysis of material transport systems – vehicle based systems – conveyor analysis.

Module 4	**Automated Storage Systems**	**10 Hrs**

Automated Storage Systems: Automated storage and retrieval systems – reasons for automating storage operations – types of AS/RS – applications of AS/RS – carousel storage systems – analysis of storage systems.

Module 5	**Adaptive Control Systems and Automated Inspection**	**10 Hrs**

Adaptive Control Systems and Automated Inspection: Introduction – adaptive control with optimization, adaptive control with constraints, application of AC. In machining operations.

Course Outcomes

Upon successful completion of the course, the students will be able to

- Explain automation strategies and transport mechanisms in automated flow Lines.
- Analyze the automated flow lines with and without buffer storage and also Multi-stage automated flow line.
- Choose appropriate material handling system for a given application.
- Analyze the principles of as/rs and carousel storage systems.
- Illustrate the aco and acc strategies to reduce the machine time
- Demonstrate the automated inspection methods.

Text Books

1. Groover.M.P, “Automation, Production Systems and Computer Integrated
2. Manufacturing”, Pearson Publications.

References:

1. Yoram Coren, “Computer Control of Manufacturing Systems”, Tata McGraw Hill.
2. P. Radha Krishnan & S. Subrahamanyarn and Raju, “CAD/CAM/CIM”, New Age International Publishers, 2008.
3. W. Buekinsham, “Automation”, PHI Publications, 3rd edition.
4. Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, “Computer Aided Manufacturing” , Pearson Publications, 2009.

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Building Materials					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0149T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

- To identify the traditional materials that are used for building constructions.
- To explain basic concepts of building components such as stair case and masonry
- To know the causes of dampness in structures and its preventive measures
- To understand the building rules, building bye laws and acoustics of building

Syllabus		**Total Hours:48**
Unit-I	**MATERIALS**	**9 Hrs**
Traditional materials: Stones- Types of stone masonry -Brick-types of brick masonry- lime Cement – Timber – Seasoning of timber - their uses in building works		
Unit-II	**BUILDING COMPONENTS**	**9 Hrs**
Lintels, Arches and Vaults – Staircases, Lifts – Types. Different types of flooring-Concrete, Mosaic, Terrazo floors; Different types of roofs- Pitched, Flat and Curved Roofs. Lean-to-Roof, Coupled Roofs, Trussed roofs - King and Queen Post Trusses. Doors & Windows-Types and Specifications		
Unit -III	**DAMPNESS**	**10 Hrs**
Dampness and its prevention: Causes of dampness- ill effects of dampness-requirements of an ideal material for damp proofing-materials for damp proofing –methods of damp proofing.		
Unit -IV	**BUILDING PLANNING**	**10 Hrs**
Elements of building planning- basic requirements-orientation-planning for energy efficiency-planning based on utility-other requirements		
Unit -V	**BUILDING RULES AND BYE-LAWS**	**10 Hrs**
Zoning regulations; Regulations regarding layouts or subdivisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index. Building Information System		

Course Outcomes(CO):

On completion of this course, student will be able to

- To understand the characteristics of different building materials
- Differentiate brick masonry, stone masonry construction and bonds used in construction of walls of buildings
- To know about the causes of dampness in buildings and its ill effects
- To understand the principles of planning in buildings
- Describe capable of understanding building rules and knowledge about, bye-laws and building elements..

Textbooks:

1. Building Drawing by M.G. Shah, C.M. Kale and S.Y. Patki, Tata McGraw-Hill, New
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, ‚Building Construction' - Laxmi Publications (P) Ltd., New Delhi.

Reference Books:

1. Building Materials, S. K. Duggal, New Age International Publications.
2. N. Kumaraswamy, A. Kameswara Rao, building planning and drawing, 7th Ed, Charotar.

E-resources:

1. http://nptel.ac.in/courses/105104103/
2. http://www.academicpub.org/jwrhe/
3. http://www.peo.on.ca/index.php/ci_id/21843/la_id/1

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)
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Principles of Communication Systems					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0430T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

This course will enable students to:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyze various modulation schemes.
- To evaluate various modulation scheme in real time applications.

Syllabus		**Total Hours:48**
Module-I	**Amplitude Modulation**	**10Hrs**

Amplitude Modulation: Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB, Radio Transmitter and Receiver.

Module-II	**Frequency Modulation**	**9Hrs**

Frequency Modulation: Introduction to Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Module-III	**Pulse Modulation**	**10Hrs**

Pulse Modulation: Sampling Theorem- Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing and Frequency Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Module-IV	**Digital Modulation**	**9Hrs**

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater, M-ary and comparison

Module-V	**Communication Systems**	**10Hrs**

Communication Systems: Satellite, RADAR, Optical, Micro wave communication, Mobile and Computer Communication (Block diagram approach only).

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concept of various modulation schemes.
- Understand the concept of Different multiplexing techniques.
- Apply the concept of various modulation schemes to solve engineering problems.
- Analyse various modulation schemes.
- Evaluate various modulation schemes in real time applications.
- Understand the concept of various Communication systems.

Textbooks:

1. Herbert Taub, Donald L Schilling and Goutam Saha, “Principles of Communication Systems”, 3 rdEdition, Tata McGraw-Hill Publishing Company Ltd., 2008.

Reference Books:

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.
2. K. Sam Shanmugam “Digital and Analog Communication Systems”, Wiley India Edition, 2008.

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Power Electronics
(Common to all Except EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0214Ta	3: 0:0:0	3	CIE: 30 SEE:70	3Hours	OEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries

Syllabus		**TH: 49 Hrs**
Unit-I	**Power Semi Conductor Devices -I**	**10 Hrs**

Classification of Switching Devices Based on Frequency and Power Handling Capacity , Thyristors – Silicon Controlled Rectifiers (SCR's) – TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors.

Unit-II	**Power Semi Conductor Devices-II**	**10 Hrs**

BJT – Power Transistor - Power MOSFET – Power IGBT – Static Characteristics – Turn On and Turn Off Methods SCR- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits- Series and Parallel Connections of SCR's – Specifications and Ratings of SCR's, BJT, IGBT

Unit -III	**Phase Controlled Converters**	**9 Hrs**

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and Bridge Connections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL Loads and RLE Load– Derivation of Average Load Voltage and Current – Effect of Source Inductance – Numerical Problems.

Unit -IV	**Inverters**	**10 Hrs**

Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms – Simple Forced Commutation Circuits for Bridge Inverters – Single Phase Half and Full Bridge Inverters-Pulse Width Modulation Control-Harmonic Reduction Techniques-Voltage Control Techniques for Inverters – Numerical Problems,

Unit -V	**AC Voltage Controllers & Cyclo Converters**	**10 Hrs**

AC Voltage Controllers – Single Phase Two SCR's in Anti Parallel – With R and RL Loads – Modes of Operation of TRIAC – TRIAC with R– Derivation of RMS Load Voltage, Current and Power Factor Wave Forms – Firing Circuits -Numerical Problems

Cyclo Converters – Single Phase Mid Point Cycloconverters with Resistive and Inductive Load (Principle of Operation only) – Bridge Configuration of Single Phase Cycloconverter (Principle of Operation only) – Waveforms

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Basic concepts of diode and transistor and its operation
- Basic operating principles of power semiconductor switching devices.
- The operation of power electronic converters, inverters, ac voltage controllers, and cycloconverter
- How to apply the learnt principles and methods to practical applications.

Textbooks:

1. Power Electronics, M. D. Singh and K. B. Khanchandani, Mc Graw Hill Education (India) Pvt. Ltd., 2nd Edition, 2007, 23rd Reprint 2015.
2. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson, 3rdEdition, 2014, 2nd Impression 2015

Reference Books:

1. Power Electronics, K. R. Varmah, Chikku Abraham, CENGAGE Learning, 1st Edition, 2016.
2. Power Electronics, P. S. Bimbhra, Khanna Publishers, 2012.
3. Power Electronics: Devices, Circuits, and Industrial Applications, V. R. Moorthi, OXFORD University Press, 1st Edition, 2005, 12th Impression 2012.

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Database Management Systems (Common to CE,EEE,ME and ECE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0512T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

This course will enable students to:

- To teach the role of database management system in an organization.
- To design databases using data modeling and Logical database design techniques.
- To construct database queries using relational algebra and calculus and SQL.
- To explore implementation issues in database transaction.
- To familiarize database security mechanisms.

Syllabus		**Total Hours:48**
Module-I	**Introduction to Database concepts and Modeling**	**10Hrs**

Conceptual Modeling Introduction: Introduction to Data bases, Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Database Systems architecture.

The Entity-Relationship Model: Overview of Database Design, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Conceptual Design with the ER Model.

Module-II	**Relational Model, Relational Algebra**	**9Hrs**

Relational Model: Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Views.

Relational Algebra: Introduction to Relational algebra, selection and projection, set operations, renaming, joins, division.

Module-III	**SQL**	**10Hrs**

SQL: Basic form of SQL Query, DDL, DML queries, Views in SQL, Joins, Nested & Correlated queries, Operators, predefined functions, Aggregate Functions.

PL/SQL: Introduction, Functions & Procedures, Triggers, Cursors.

Module-IV	**Normalization**	**9Hrs**

Relational database design: Introduction, Functional Dependencies (FDs), Normalization for relational databases: 1NF, 2NF, 3NF and BCNF, Basic definitions of Multi Valued Dependencies, 4NF and 5NF.

Module-V	Transaction Management &Concurrency Control and Recovery	10Hrs

Transaction Management: Transaction processing, Transaction Concept, Transaction States, Implementation of Atomicity and Durability, Concurrent Executions.

Concurrency Control: Lock-Based Protocols, Timestamp- Based Protocols, Validation-Based Protocols, Multiple Granularity.

Recovery: Failure Classification, Recovery and Atomicity, Log-Based Recovery.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the Basic Concepts of Database languages, Relational model, SQL.
- Choose the specific Data models for large enterprise database design.
- Analyze the data efficiently through SQL instructions.
- Apply Normal forms on database for eliminating the redundancy.
- Demonstrate the Basic Concepts of transaction management techniques
- Apply concurrency control techniques for Database recovery.

Textbooks:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, Tata McGraw-Hill Publishing Company,2017.
2. Raghu Ramakrishnan, Database Management System, 3rd Edition, Tata McGraw-Hill Publishing Company, 2014.

Reference Books:

1. Peter Rob, A.Ananda Rao, Corlos Coronel, Database Management Systems (for JNTU), Cengage Learning, 2011.
2. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Database System Implementation, 1st Edition, Pearson Education, United States, 2000.
3. E. Ramez and Navathe, Fundamental of Database Systems, 7th Edition, Pearson Education
4. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2016.
5. Carlos Coronel and Steven Morris, Database Systems: Design, Implementation, and Management, 12th edition, Cengage Learning,2016.
6. John V. ,Absolute beginner's guide to databases, Petersen, QUE

E-resources:

1. https://www.coursera.org/learn/database-management
2. https://www.coursera.org/learn/sql-data-science
3. https://www.w3schools.com/sql/
4. https://www.youtube.com/watch?v=fHAfc7Hjq28&list=PLWPirh4EWFpGrpcMfZ6UcdI786QdtSxV8
5. https://www.youtube.com/watch?v=HwmEcudlv44&list=PL4OCRJojkV1jN-Ed6RkQpWfBvqe0utRd6
6. http://www.w3schools.in/dbms/
7. https://www.geeksforgeeks.org/dbms/
8. https://www.javatpoint.com/dbms-tutorial
9. https://www.edureka.co/blog/dbms-tutorial/

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Machine Tools and Metrology Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0319P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To understand the working principles of various machines viz lathe , Drilling, milling, shaping.
- To understand the working of grinding machines, slotting machine, EDM.
- Different alignment techniques.

Syllabus | **Total Hours:45**

PART A-Machine Tools

1. Introduction of general purpose machines -Lathe, Drilling machine, Milling machine, Shaper.
2. Planning machine, slotting machine, Cylindrical Grinder, surface grinder andtool and cutter grinder.
3. Step turning and taper turning on lathe machine
4. Thread cutting and knurling on -lathe machine.
5. Drilling and Tapping
6. Shaping and Planning
7. Slotting
8. Milling

PART-B Metrology

1. Measurement of lengths, heights, diameters by Vernier calipers micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, Vernier calipers and checking the Chordal Addendum and Chordal Height of spur gear.
4. Machine tool Alignment of test on the lathe.
5. Machine tool alignment test on milling machine.

Course Outcomes (CO):

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

- Various job Operation on machine tools.
- To know about various grinding and shaping machines.
- Exposure to various measuring systems.

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CAD/CAM/CAE Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0324P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To write program for CAD modeling.
- To learn part programming and path generation from a CAD model.
- To train on machining of various parts in CNC machines.
- To introduce fundamentals of the analysis software, its features and applications.
- To learn the basic element types in Finite Element analysis.
- To know the concept of discretization of continuum, Loading conditions and analyse the structure using pre-processor and postprocessor conditions.

Syllabus | **Total Hours:45**

Part A: CAD/CAM

1. Introduction to CAD/CAM software packages.
2. Development of part drawings in the form of orthographic & isometric, Modelling of various parts, Assembly Modelling of various parts.
3. Study of various post processors used in NC Machines.
4. Development of NC code for free form and sculptured surfaces using CAM packages.
5. Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package.

Part B: CAE

1. 2D & 3D beam analysis with different sections, different materials for different loads (forces and moments) with different end supports
2. Static analysis of plate with a hole to determine the deformations, the Stresses to study the failure behavior and SCF.
3. Static analysis of connecting rod with tetrahedron and brick elements
4. Buckling analysis of plates, shells and beams to estimate BF and modes
5. Modal analysis of beams, plates and shells for natural frequencies and mode shapes
6. Steady state heat transfer Analysis Cross section of chimney and transient heat transfer analysis of solidification of castings.
7. CFD analysis of airfoil design
8. CFD analysis of ducts/impeller/fan

The following packages can be used in lab.

Auto Cad, CATIA, Pro-E, I-DEAS, Iron- CAD, Edge CAM, Master CAM, any CAE package.

Course Outcomes (CO):

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

- Generate CAD models.
- Write CNC programs for various machining operations
- Classify the types of Beams (2D & 3D) with various cross sections to determine Stress, Strains and deflections under static loading.
- Analyze connecting rod with tetrahedron and brick elements
- Predict the natural frequencies and modes shapes using Modal, Also finding the critical load using Buckling analysis Simulate steady state heat transfer.

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Soft Skills					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0028P	**1: 0:2:0**	**2**	**CIE: 30 SEE:70**	**3Hours**	**SOC**

Course Objectives:

Impart the knowledge of vehicle structure and its components.

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To develop leadership skills and organizational skills through group activities
- To function effectively with heterogeneous teams

Syllabus		**Total Hours:42**
UNIT - I	**Soft Skills & Communication Skills**	**10 Hrs**

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT - II	**Critical Thinking**	**10 Hrs**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT - III	**Problem Solving & Decision Making**	**10 Hrs**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion.

UNIT - IV	Emotional Intelligence & Stress Management	12 Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT - V	Leadership Skills	12 Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

Course Outcomes(CO):

By the end of the program students should be able to

- Memorize various elements of effective communicative skills
- Interpret people at the emotional level through emotional intelligence
- Apply critical thinking skills in problem solving
- Analyse the needs of an organization for team building
- Judge the situation and take necessary decisions as a leader
- Develop social and work-life skills as well as personal and emotional well-being

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.) Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor Publisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

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Design Thinking for Innovation
(Mandatory Course)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0030M	2: 0:0:0	0	CIE: 30 SEE:70	3Hours	MC

Course Objectives:

- The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to Design Thinking**	**10 Hrs**
Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.		
UNIT - II	**Design Thinking Process**	**8 Hrs**
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development **Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.		
UNIT - III	**Innovation**	**8 Hrs**
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity. **Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.		
UNIT - IV	**Product Design**	**8 Hrs**
Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies. **Activity:** Importance of modelling, how to set specifications, Explaining their own product design.		
UNIT - V	**Design Thinking in Business Processes**	**8 Hrs**
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. **Activity:** How to market our own product, About maintenance, Reliability and plan for startup.		

Course Outcomes (CO):

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

Textbooks:

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

Reference Books:

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H.

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Mechanical Engineering
III B.TECH.

Semester-VI (Theory–6, Lab–1, Skill course-1, Mandatory course-1)							
S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	22A0325T	Dynamics of Machinery	PCC	2	1	0	3
2.	22A0326T	Design of Machine Elements	PCC	3	0	0	3
3.	22A0327T	Heat Transfer	PCC	2	1	0	3
4.	22A0329T	**Professional Elective Course-II**	PEC	3	0	0	3
	22A0329Ta	Renewable Energy Sources					
	22A0329Tb	Introduction to Composites					
	22A0329Tc	Measurements and Mechatronics					
5.		**Open Elective Course – II**	OEC	3	0	0	3
	22A0150T	Environmental Economics					
	22A0431T	Micro controller and applications					
	22A0213Ta	Control Systems Engineering					
	22A0528T	Introduction to Machine learning					
6.	22A0023T	Management science	HSSC	3	0	0	3
	22A0024T	Entrepreneurship & Innovation					
	22A0026T	Human Resource Management					
7.	22A0328P	Heat Transfer Lab	PCC	0	0	3	1.5
8.	22A0331P	**Skill Oriented course** 3D Printing practice	SOC	1	0	2	2
9.	22A0031T	**Mandatory Course** Intellectual Property Rights & Patents	MC	2	0	0	0
						Total	**21.5**
Industry Internship/Research Internship is mandatory during Summer vacation							

Distribution of Credits among the Category of Courses		
S.No	Category of Courses Introduced	Credits Assigned
1	Professional Core Courses (3T+1L)	10.5
2	Professional Elective Courses (1T)	3
3	Open Elective Course Courses (1T)	3
4	Humanities and Social Science Courses (1T)	3
5	Skill Oriented Course – 1 (T+P)	2
6	Mandatory Non Credit Course (1T)	0
Total Credits		21.5

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Dynamics of Machinery					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0325T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- Analysis of forces acting in mechanisms
- Effects of unbalance forces
- Modelling and analyzing the vibration behaviour of spring mass damper system
- The principles in mechanisms used for governing of machines

Syllabus		**Total Hours:45**
Module - I	**Friction and Power Screws**	**9 Hrs**

Friction: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

Power screws: Forms of threads, self locking of screws, efficiency of different screws, Square, trapezoidal, screw threads.

Module - II	**Precession, Turning Moment Diagram and Fly Wheel**	**9 Hrs**

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motorcycle, aeroplanes and ships.

Turning Moment Diagrams and Fly Wheels: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

Module - III	**Governors**	**9 Hrs**

Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

Module - IV	Balancing	**9 Hrs**

Balancing: Balancing of rotating masses - single and multiple – single and different planes.

Balancing Of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder inline and radial engines for primary and secondary balancing.

Module - V	**Vibration**	**9 Hrs**

Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Torsional vibrations - two and three rotor systems.

Course Outcomes:

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

- Determine the forces acting on various linkages when a mechanism is subjected to external forces.
- Identify and correct the unbalances of rotating body
- Analyze the vibratory motion of SDOF systems.
- Reduce the magnitude of vibration and isolate vibration of dynamic systems
- Determine dimensions of Governors for speed control.

Text Books:

1. S.S. Rattan, Theory of Machines, MGH Publishers,3/e,2013.
2. R.L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw Hill, 2017.

Reference Books:

1. Thomas Bevan, Theory of machines, Pearson, 3/e,2012.
2. J.E. Shigley, The theory of machines and mechanisms, McGraw hill, 2/e, 1995.
3. R.S.Khurmi, J.K.Guptha, Theory of machines S.Chandpublications, 2005.

Online Learning Resources:

1. https://nptel.ac.in/courses/112104114
2. https://nptel.ac.in/courses/112101096
3. https://archive.org/details/NPTEL-MechEngr-Dynamics_of_Machines
4. https://www.youtube.com/watch?v=OlZXxPVpmBs
5. https://www.digimat.in/nptel/courses/video/112104114/L01.html

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Design of Machine Elements					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0326T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- Provide an introduction to design of machine elements.
- Familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- Explain design procedures to different types of joints.
- Teach principles of clutches and brakes and design procedures.
- Instruct different types of bearings and design procedures.

Syllabus		**Total Hours:42**
UNIT - I		**12 Hrs**

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials.
Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.
Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Fatigue theories of failure. Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

UNIT - II		**10 Hrs**

Design of Bolted Joints: Threaded fastiness, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, eccentrically loaded bolted joints, gasketedjoints.
Riveted Joints: Design of lap, butt and eccentrically loaded joints, failure and efficiency of riveted joints.

Welded Joints: Strength of lap and butt welds, eccentrically loaded welded joints. Joints subjected to bending and torsion

UNIT - III		**10 Hrs**

Keys: Function, types, design of sunk, saddle, Kennedy and Woodruff keys.
Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.
Couplings: Design of flange and bushed pin couplings, universal coupling.

Springs: Design of helical compression, tension, torsion and leaf springs

UNIT - IV		**12 Hrs**

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

UNIT - V		12 Hrs

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

Design of Gears: Spur gears, beam strength, Lewis equation, design for dynamic and wear loads.

Course Outcomes (CO):

- At the end of the course the students will be able to
- Estimate safety factors of machine members subjected to static and dynamic loads. (l5)
- Design fasteners subjected to variety of loads. (l6)
- Select of standard machine elements such as keys, shafts, couplings, springs and bearings. (l1)
- Design clutches, brakes and spur gears. (l6)

Textbooks:

1. J.E. Shigley, “Mechanical Engineering Design”, 2nd edition, Tata McGraw Hill, 1986.
2. V.B.Bhandari, “Design of Machine Elements”, 3rd edition, Tata McGraw Hill, 2010.

Reference Books:

1. R.L. Norton, “Machine Design an Integrated approach”, 2nd edition, Pearson Education, 2004.
2. R.K. Jain, “Machine Design:, Khanna Publications, 1978.
3. M.F.Spotts and T.E.Shoup, “Design of Machine Elements”, 3rd edition, Prentice Hall (Pearson Education), 2013.

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Heat Transfer					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0327T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To impart the basic laws of conduction, convection and radiation heat transfer and their applications.
- To familiarize the convective heat transfer concepts.
- To describe the heat transfer phenomena during phase change.
- To explain basics of radiation heat transfer.
- To make conversant with the heat transfer analysis related to thermal systems like heat exchangers, evaporator and condenser.

Syllabus		**Total Hours:42**
UNIT - I	**Conduction Heat Transfer**	**12 Hrs**

Introduction : Modes and mechanisms of heat transfer – Basic laws of Heat Transfer – General Applications of Heat Transfer – Problems.

Conduction Heat Transfer : Fourier Rate Equation – General Heat Conduction Equation in Cartesian, Cylindrical and Spherical Coordinates, Simplification and Forms of the Field Equation – Steady, Unsteady and Periodic Heat Transfer – Boundary and Initial Conditions – Problems.

One Dimensional Steady State Heat Conduction : Solution for Plane and Composite Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy – Critical Radius/Thickness of Insulation – Problems.

UNIT - II	**Conduction Heat Transfer**	**10 Hrs**

One Dimensional Unsteady State/Transient Heat Conduction Transient Heat Conduction – Systems with Negligible Internal Resistance – Significance of Biot and Fourier Numbers – Lumped System Analysis and Use of Heisler Charts – Problems.

First Heat Transfer in Extended Surfaces (Fins) : Heat Conduction through Fins of Uniform Cross Section – Efficiency, Effectiveness and Temperature Distribution on Long Fin, Fin with Insulated Tip and Short Fin – Problems.

UNIT - III	**Convective Heat Transfer**	**10 Hrs**

Convective Heat Transfer :

Convection : Basic Concepts of convection – heat transfer coefficients – Types of convection – Free and Forced Convection – Significance of Non-Dimensional Numbers.

Free Convection : Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate – Use of Emperical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation – Problems.

Forced Convection :

External Flows : Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for flow over Flat Plates and Cylinders – Fluid Friction-Heat Transfer Analogy – Problems.

Internal Flows : Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow – Problems.

Heat Transfer with Phase Change :

Boiling : Pool Boiling – Regimes-Nucleate, Transition and Film Boiling.

Condensation : Film wise and Drop wise Condensation.

UNIT - IV	Radiative Heat Transfer	12 Hrs

Radiative Heat Transfer : Thermal Radiation – Surface Emission Properties and Characteristics – Absorptivity, Reflectivity and Transmissivity – Different bodies-Black, Grey, Opaque and White bodies – Concept of a Black Body – Laws of Black Body Radiation – Irradiation – Total and Monochromatic Quantities – Laws of Planck, Wien, Kirchhoff, Lambert and Stefan-Boltzmann – Heat Exchange between two Black Bodies – Concepts of Shape Factor – Emissivity – Heat Exchange between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

UNIT - V	Heat Exchangers	12 Hrs

Heat Exchangers : Classification of Heat Exchangers – Overall Heat Transfer Coefficient and Fouling Factor – Concepts of LMTD and NTU Methods – Problems.

Course Outcomes (CO):

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

- Apply the concepts of different modes of heat transfer.
- Apply knowledge of conduction heat transfer in the design of insulation of furnaces and pipes.
- Analyze free and forced convection phenomena in external and internal flows.
- Design thermal shields using the concepts of black body and non – black body radiation.
- Apply the basics of heat transfer for applications in industries in heat exchangers.

Textbooks:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 5th Edition, New Age International Publications, 2017.
2. Heat Transfer, P.K. Nag, TMH Publications, 3rd Edition.
3. Heat Transfer, J.P. Holman and Bhattacharya, Special Indian Edition (10th), TMH Publications, 2017.

Reference Books :

1. A Textbook of Heat and Mass Transfer, R.K. Rajput, S.Chand Publications, Revised Edition, 2018.
2. Heat and Mass Transfer, D.S. Kumar, 8th Edition, S.K. Kataria and Sons, 2013.
3. Heat and Mass Transfer, Arora & Domkundwar, Dhanpat Rai & Co. Publications.
4. Principles of Heat Transfer, Frank Kreith, R.M. Manglik & M.S. Bohn, Cengage Learning Publishers, Special Edition.
5. Heat and Mass Transfer, R. Yadav, 6th Edition, Central Publishing House, 2011.
6. Incropera's Principles of Heat and Mass Transfer, F.P. Incropera, D.P. Dewitt, T.L. Bergman and A.S. Lavine, Wiley India Edition, 2018.
7. Heat Transfer, S.P. Sukhatme, TMH, 2009.

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Renewable Energy Sources					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0329Ta	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To be familiar with classification and characteristics of composite material and their applications.
- To gain the knowledge about manufacturing methods of composites.
- To know the testing methods related to composite materials.

Syllabus		**Total Hours:42**
UNIT - I		**12 Hrs**

Energy Sources and Their Availability: Conventional and non-conventional energy sources. Need of Renewable Energy Sources (RES), classification of RES, role and potential of RES in India.

Solar Radiation: Structure of the sun, solar constant, environmental impact of solar radiation, radiation at the earth surfaces, solar radiation measuring instruments, solar radiation Geometry, extraterrestrial and terrestrial solar radiation, spectral distribution of extraterrestrial radiation, solar radiation on tilted surfaces and empirical equations for estimating solar radiation.

UNIT - II		**10 Hrs**

Solar Collectors: Principles of the conversion of solar radiation into heat, classifications of solar collectors- flat plate collectors and concentrating collectors, collector materials, performance analysis of a flat plate collector.

Solar Energy Storage and applications: Different storage methods-sensible and latent heat, solar ponds, solar water heating, space heating /cooling, solar electric conversion, solar distillation, solar pumping, solar furnace, solar cooking and solar green house

UNIT - III		**10 Hrs**

Wind Energy: Principles of wind energy conversion, site selection consideration, basic components, types of wind machines – horizontal axis and vertical axis, applications, Betz coefficient.

Biomass Energy Conversion Systems: Biomass conversion technologies, photosynthesis, biogas generation, factors affecting bio-digestion, classification of biogas plants, advantages and disadvantages, bio mass gasification

Geothermal Thermal Energy: Resources, types of wells, methods of harnessing the energy.

UNIT - IV		12 Hrs

Ocean Thermal Energy: Methods of Ocean thermal electric power generation open cycle systems, closed cycle systems

Tidal Power System: Working principle, components of tidal power plant, single basin and double basin tidal energy system advantages and limitations.

Wave Energy: Wave energy conversion Devices-wave energy conversion by floats, high level reservoir wave machine and dolphin type wave power machine. Advantages and disadvantages.

UNIT - V		12 Hrs

Direct Energy Conversion: Need for DEC, limitations, principles of DEC. thermoelectric Power – See-beck, Peltier, Joule -Thomson effects, Thermo-electric Power generators

MHD Power Generation: Principles, dissociation and ionization, Hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion.

Fuel Cell: Working principle, classification – efficiency – VI characteristics

Course Outcomes (CO):

Upon successful completion of the course, the students will be able to

- Classify various types of renewable sources of energy and illustrate the principles of solar radiation.
- Evaluate solar flat plate collector efficiency and illustrate various solar energy storage methods and applications.
- Describe the techniques of exploiting wind, biomass and geothermal energies in power generation.
- Illustrate the methods of tapping ocean thermal, tidal and wave energies in power generation.
- Describe the working of various direct energy conversion systems and their applications.

Textbooks:

1. SP Sukhatme, “Solar Energy: Principles of thermal collection and storage” Tata McGraw Hill
2. Tiwari and Ghosal, “Renewable Energy Resources: Basic Principles and Applications”, narosa
3. 3. G.D. Rai, “Non-Conventional Energy Sources”, Dhanpat Rai and Sons

Reference Books:

1. B.H.Khan, “Non – conventional Energy Resources”, Tata McGraw Hill education Pvt. Ltd.
2. Twidell & Weir, “Renewable Energy Sources “. Routledge (Taylor &Francis Group)

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Introduction to Composites					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0329Tb	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To be familiar with classification and characteristics of composite material and their applications.
- To gain the knowledge about manufacturing methods of composites.
- To know the testing methods related to composite materials.

Syllabus		**Total Hours:42**
UNIT - I	**Introduction**	**12 Hrs**

Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.

UNIT - II	**Manufacturing methods**	**10 Hrs**

Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength.

UNIT - III	**Mechanical Properties**	**10 Hrs**

Stiffness and Strength: Geometrical aspects – volume and weight fraction. Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements – Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.

UNIT - IV	**Laminates**	**12 Hrs**

Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Plate Stiffness and Compliance, Computation of Stresses, Types of Laminates -, Symmetric Laminates, Anti-symmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Crossply Laminate, Angle-ply Laminate. Orthotropic Laminate, Laminate Moduli, Hygrothermal Stresses.

UNIT - V	**Joining Methods and Failure Theories**	**12 Hrs**

Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.

Course Outcomes(CO):

- To provide knowledge on characteristics of composites
- To get knowledge on manufacturing and testing methods and mechanical behaviour of composites.
- To get the exposure of different materials .

Textbooks:

1. K.K. Chawla, (1998), Composite Materials, Springer-Verlag, New York 2. B.T. Astrom, (1997),
2. Manufacturing of Polymer Composites, Chapman & Hall
3. Composite materials by J.N.Reddy

Reference Books:

1. Stuart M Lee, J. Ian Gray, Miltz, (1989), Reference Book for Composites Technology, CRC press
2. Frank L Matthews and R D Rawlings, (2006), Composite Materials: Engineering and Science, Taylor and Francis.
4. D. Hull and T.W. Clyne, (1996), Introduction to Composite Materials, Cambridge University Press
5. Analysis and Performance of Fiber Composites by Bhagwan D. Agarwal
3. Mechanics of Composite Materials by Autar K. Kaw

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Measurements and Mechatronics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0329Tc	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To instruct the principles of interchangeable manufacture.
- To introduce basic principles of mechanical measurements.
- To impart knowledge on mechatronics systems.

Syllabus		**Total Hours:42**
UNIT - I	**Limits & Fits**	**12 Hrs**

Introduction, terminology pertaining to limits and fits – unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability, deterministic & statistical tolerance, selective assembly. International Standard system of limits and fits

Limit Gauges: Taylor's principle – Classification and design of limit gauges.

UNIT - II	**Linear and Angular Measurements**	**10 Hrs**

Line and end standards, slip gauges and length bars. bevel protractor – angle slip gauges – spirit levels and auto collimator.

Interferometry Applied to Measurement: NPL flatness interferometer and NPL gauge interferometer.

Surface Roughness Measurement: Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA, R.M.S, Rz values, Methods of measurement of surface finish – Profilograph, Talysurf

UNIT - III	**Mechanical Measurements**	**10 Hrs**

Introduction to measurement: Elements of generalized measurement system

Displacement Measurement- Linear Variable Differential Transformer (LVDT), encoders, potentiometers.

Temperature Measurement - Pyrometers, Resistance Temperature Detector (RTD)

Strain Measurement-Electrical strain gauge – gauge factor – method of usage of resistance strain gauge

UNIT - IV	**Mechatronics Systems**	**12 Hrs**

Mechatronics systems- Elements of mechatronics system, mechatronics design process, system - measurement systems, control systems, programmable logic controllers, case studies of mechatronic systems

UNIT - V	**Actuating Systems**	**12 Hrs**

Hydraulic and pneumatic actuating systems - fluid systems, hydraulic systems, and pneumatic systems, components, control valves. mechanical actuating systems and electrical actuating systems – basic principles and elements.

Course Outcomes (CO):

Upon successful completion of the course, the students will be able to

- design the limit gauges for interchangeable manufacture.
- apply the basic principles of mechanical measurements for engineering practice.
- illustrate the role of mechatronics systems in manufacturing.
- explain principles of mechanical, hydraulic, pneumatic and electrical actuating systems.

Textbooks:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers.
2. BeckWith, Marangoni, Linehard, " Mechanical Measurements", 6th edition,PHI / PE.
3. W. Bolton , "Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg.", 4th Edition, Pearson, 2012.

Reference Books:

1. IC Guptha,"Engineering Metrology ",Danpath Rai Publications.
2. Doeblin Earnest. O. Adaptation by Manik and Dhanesh,"Measurement Systems: Application and Design", Tata Mc Graw Hill Publications.

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Environmental Economics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0150T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

Syllabus		**Total Hours:48**
Unit-I	**Sustainable Development**	**9 Hrs**

Introduction to sustainable development - Economy-Environment interlinkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy

Unit-II	**Environmental Degradation**	**9 Hrs**

Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.

Unit -III	**Economics Of Pollution**	**10 Hrs**

Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.

Unit -IV	**Cost – Benefit Analysis**	**10 Hrs**

Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.

Unit -V	**Economics of Biodiversity**	**10 Hrs**

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report

Course Outcomes(CO):

On completion of this course, student will be able to

- The information on sustainable development and economics of energy
- The information regarding environmental degradation and economic analysis of degradation
- The identification of economics of pollution and their management
- The cost benefit analysis of environmental resources
- The principles of economics of biodiversity

Textbooks:

1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)

Reference Books:

1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaft, London. (1994),
2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),

E-resources:

- **https://nptel.ac.in/courses/109107171**

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Microcontrollers & Applications					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0431T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

Syllabus		**Total Hours:48**
Module-I	**8051 Microcontroller**	**9 Hrs**

8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

Module-II	**Assembly language program**	**9 Hrs**

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

Module -III	**8051 Stack, Stack and Subroutine instructions**	**10 Hrs**

8051 Stack, Stack and Subroutine instructions: Simple Assembly language program examples to use subroutine instructions.8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.

Module -IV	**8051 Serial Communication**	**10 Hrs**

8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch.

Module -V	**8051 C programming**	**10 Hrs**

8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and Opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the importance of Microcontroller

- Acquire the knowledge of Architecture of 8051 Microcontroller.
- Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.
- Develop the 8051 Assembly level programs using 8051 instruction set.
- Design the Interrupt system
- Understand the operation of Timers/Counters and Serial port of 8051.

Textbooks:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems – using assembly and C", PHI, 2006 / Pearson, 2006.
2. Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson/Cengage Learning.

Reference Books:

1. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

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Control Systems Engineering
(Common to all Except EEE & ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0213TA	3: 0:0:0	3	CIE: 30 SEE:70	3Hours	OEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Merits and demerits of open loop and closed loop systems; the effects of feedback
- The use of block diagram algebra and Mason's gain formula
- Transient and steady state responses , time domain specifications
- Frequency domain specifications, Bode diagrams and Nyquist plots
- The fundamental aspects of modern control

Syllabus		**Total Hours:49**
Unit-I	**INTRODUCTION**	**10 Hrs**

Open Loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback Characteristics, Effects of positive and negative feedback. Mathematical models – Differential equations of Translational and Rotational mechanical systems, and Electrical Systems, Block diagram reduction methods – Signal flow graph - Reduction using Mason's gain formula. Transfer Function of DC Servo motor - AC Servo motor - Synchro transmitter and Receiver.

Unit-II	**TIME RESPONSE ANALYSIS**	**10 Hrs**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants

Unit -III	**STABILITY**	**9 Hrs**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci effects of adding poles and zeros to G(s)H(s) on the root loci.

Unit -IV	**FREQUENCY RESPONSE ANALYSIS**	**10 Hrs**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram Stability Analysis from Bode Plots. Polar Plots- Phase margin and Gain margin-Stability Analysis.

Unit -V	**STATE SPACE ANALYSIS**	**10 Hrs**

Concepts of state, state variables and state model, derivation of state models from differential equations. Transfer function models. Block diagrams. Diagonalization. Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Evaluate the effective transfer function of a system from
- block diagram reduction techniques (ii) Mason's gain formula
- Compute the steady state errors and transient response characteristics
- Determine the absolute stability and relative stability of a system
- Design a compensator to accomplish desired performance
- Derive state space model of a given physical system and solve the state equation

Textbooks:

1. Modern Control Engineering, Katsuhiko Ogata, PEARSON, 1st Impression 2015.
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, New Age International Publishers, 5th edition, 2007, Reprint 2012.

Reference Books:

1. Automatic Control Systems, Farid Golnaraghi and Benjamin. C. Kuo, WILEY, 9th Edition, 2010.
2. Control Systems, Dhanesh N. Manik, CENGAGE Learning, 2012.
3. John J D'Azzo and C. H. Houpis , "Linear Control System Analysis and Design: Conventional and Modern", McGraw - Hill Book Company, 1988.

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Introduction to Machine Learning					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0528T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The objectives of the course are to make the students learn about:

- Understand basic concepts of Machine Learning
- Study different learning algorithms
- Illustrate evaluation of learning algorithms

Syllabus		**Total Hours:48**
Module-I	**Introduction – Human Learning & Machine Learning**	**10Hrs**

Human Learning, Types of Human Learning, Machine Learning, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning.

Basic types of Data in Machine Learning, Data Preprocessing : Data Cleaning, Data transformation and Data Reduction

Module-II	**Modeling and Evaluation**	**9Hrs**

Introduction, selecting a Model, training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model

Module-III	**Supervised Learning :Classification**	**10Hrs**

Classification – Methods of Classification : Classification model, Classification Learning Steps, Classification by Decision tree Induction, Classification by Back propagation, K-Nearest Neighbor Classification, Random Forest Algorithm, Naïve Baye's Classification

Module-IV	**Supervised Learning : Regression**	**10Hrs**

Regression – Assumptions in Regression Analysis, Types of Regression: Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression, Curve Fitting- Method of Least Squares.

Module-V	**Unsupervised Learning : Clustering**	**9Hrs**

Clustering- Different types of clustering techniques, Partitioning Methods: K-Means Algorithm, K-Medoid's algorithm, Hierarchical Clustering Methods, Density based Clustering Methods- DBSCAN, DENCLUE, OPTICS

Course Outcomes(CO):

On completion of this course, student will be able to

- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Design application using machine learning techniques

Textbooks:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, “Introduction to Machine Learning”, MIT Press, 2004.
2. Stephen Marsland, “Machine Learning -An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Andreas C. Müller and Sarah Guido “Introduction to Machine Learning with Python: A Guide for Data Scientists”, Oreilly.

Web Resources:

1. Andrew Ng, “Machine Learning Yearning”
2. https://www.deeplearning.ai/machine-learning-
3. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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NELLORE – 524137 (A.P) INDIA

Management science					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0023T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

- To provide fundamental knowledge on Management, Administration,Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts.
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management.
- To make the students aware of the contemporary issues in management.

Syllabus		**Total Hours:60**
Module - I	**Introduction To Management**	**12 Hrs**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - Organisational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Module - II	**Operations Management**	**12 Hrs**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control - Deming's contribution to Quality. Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Concept - Meaning - Nature- Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Module - III	**Human Resources Management**	**12 Hrs**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.

Module - IV	Strategic & Project Management	12 Hrs
Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).		
Module - V	**Contemporary Issues in Management**	**12 Hrs**
The concept of Management Information System(MIS) - Materials Requirement Planning (MRP)- Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.		

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concepts & principles of management and designs of organizationin a practical world(L2)
- Apply the knowledge of Work-study principles & Quality Control techniques in industry(L3)
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.(L4)
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.(L3)
- Create Modern technology in management science.(L3)

Textbooks:

1. A.R Aryasri, “Management Science”, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

Reference Books:

1. Koontz & Weihrich, “Essentials of Management”, 6th edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, “Management Principles and Guidelines”,Biztantra.
3. Kanishka Bedi, “Production and Operations Management”, Oxford University Press, 2004.
4. Samuel C.Certo, “Modern Management”, 9th edition, PHI, 2005

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Entrepreneurship & Innovation					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0024T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSSC**

Course Objectives:

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up ofNew enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance toentrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

Syllabus		**Total Hours: 48**
Module - I	**Introduction to Entrepreneurship**	**10 Hrs**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

Module - II	**Starting Up New Venture**	**10 Hrs**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

Module - III	**Sources Of Finanace**	**9 Hrs**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

Module - IV	**Women Entrepreneurship**	**9 Hrs**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

Module - V	Introduction to Incubation & Innovation	10 Hrs

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation – Types, Advantages and Disadvantages of incubation.
Innovation Meaning & Definition - Forms of innovation - Innovation, features and characteristics - Factors initiating innovations - Innovation process and its stages.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concept of Entrepreneurship and challenges in the world of competition. (L2)
- Apply the Knowledge in generating ideas for New Ventures.(L3)
- Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.(L4)
- Evaluate the role of central government and state government in promoting entrepreneurship.(L3)
- Create and design business plan structure through incubations.(L3)

Textbooks:

1. D F Kuratko and T V Rao, "Entrepreneurship**"** - A South-Asian Perspective – CengageLearning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)
2. Nandan H, " Fundamentals of Entrepreneurship", PHI, 2013

Reference Books:

1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012.
2. Rajeev Roy "Entrepreneurship", 2nd Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwana‖ "Entrepreneurship Development: Text & Cases", Excel Books,2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

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Human Resource Management					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0026T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSSC**

Course Objectives:

- To make the student understand about human resource management.
- To enable the students about job analysis, job specification and job enrichment.
- To enable the students knowing about HR planning and retention.
- To impact knowledge about recruitment, selection and performance appraisal.
- To create knowledge on training and development, compensation management.

Syllabus		**Total Hours:48**
Module - I	**Human Resource Management-Introduction**	**9 Hrs**

Introduction- Objectives – Scope & Features of HRM – Importance & - Functions of HRM- Challenges of HRM. Personnel Management Vs HRM – Role of HR manager - Strategic Human Resource Management.

Module - II	**Job Analysis and Job Design**	**9 Hrs**

Job Analysis Process –Techniques of Data Collection - Contents of Job Description & Job Specification - Job design - Factors affecting Job design - Job enrichment Vs Job enlargement.

Module - III	**Human Resource Planning and Employee Retention**	**10 Hrs**

Objectives and Need of HR planning, Process of HR Planning and factors affect the HR Planning -HR Information System - Employee retention - Importance of retention - strategies of retention.

Module - IV	**HR Acquisition and Managing Employee Performance**	**10 Hrs**

Recruitment - Objectives and Sources of recruitment - Selection - Objectives - Selection Procedure - Placement - Performance Appraisal –Objectives & Importance, performance Appraisal Methods – Constraints.

Module - V	**HR Development and Compensation Management**	**9 Hrs**

Training and Development– Objectives, Need and Methods of Training –career planning and career development - Compensation Management - Job evaluation – welfare provisions and fringe benefits - Quality Circles and Total Quality Management.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the basic concept of Human Resource Management.(L2)
- Explain the job analysis and job design methods.(L2)
- Understand the demand and supply of HR & concept of employee retention.(L2)
- Understand the sources of Recruitment, Selection process and Performanceappraisal methods.(L2)
- Examine the Training and Development methods and compensation management process.(L2)

Textbooks:

1. Gary Dessler, Biju Varkkey, Human Resource Management, 4e, Pearson 2017.
2. Robert L. Mathis, John H. Jackson, Manas Ranjan Tripathy, Human ResourceManagement, Cengage Learning 2016.

Reference Books:

1. Aswathappa, Human Resource Management, 4th Edition, TMH 2006.
2. Subbarao, Personnel and Human Resource Management –Text and cases,Himalaya, 2009
3. R.Wayne Mondy, Robert M.Noe, Human Resource Management, Pearson
4. Noea.Raymond, John Hollenbeck, Barry Gerhart and Patrick Wright, HumanResource Management, Tata McGraw Hill.
5. Muller, Human Resource Management a case study approach, Jaico Publishers,2008
6. VSP Rao, Human Resource Management, Text and Cases, Excel Books 2006.

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Heat Transfer Laboratory					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0328P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

Students undergoing this course would

- Understand different modes of heat transfer
- Gain knowledge about natural and force convection phenomenon
- Estimate experimental uncertainty in measurements

Syllabus **Total Hours:45**

1. Determine the overall heat transfer coefficient across the width of composite wall
2. Determine the thermal conductivity of a metal rod
3. Determine the thermal conductivity of insulating powder material through concentric sphere apparatus
4. Determine the thermal conductivity of insulating material through lagged pipe apparatus
5. Determine the efficiency of a pin fin in natural and forced convection.
6. Determine the heat transfer coefficient for a vertical cylinder in natural convection
7. Determine the heat transfer coefficient in forced convection of air in a horizontal tube.
8. Determine the heat transfer coefficients on film and drop wise condensation apparatus.
9. Determine the effectiveness of a parallel and counter flow heat exchanger.
10. Study the pool boiling phenomenon and different regimes of pool boiling.
11. Experiment on pool boiling
12. Determine the emissivity of the test plate surface.
13. Experiment on Stefan-Boltzmann apparatus
14. Determine the heat transfer rate coefficient in fluidized bed apparatus.

Course Outcomes (CO):

On completion of this course, student will be able to

- Explain different modes of heat transfer
- Identify parameters for measurement for calculating heat transfer
- Determine effectiveness of heat exchanger
- Design new equipment related to heat transfer
- Apply principles of heat transfer in wide application in industries.

Reference Books:

1. Abdul Matheen, Heat Transfer Laboratory Manual, Laxmi Publications; 2/e, 2007.

Online Learning Resources/Virtual Labs:

- https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab
- https://www.iare.ac.in/sites/default/files/lab1/IARE_HT_LAB_MANUAL.pdf
- https://mrcet.com/downloads/digital_notes/ME/III%20year/(R18A0388)Heat%20Transfer%20Lab.pdf
- https://mrcet.com/downloads/ME/Mech%20III-II.pdf

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3D Printing practice					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0331P	**1: 0:2:0**	**2**	**CIE: 30 SEE:70**	**3Hours**	**SOC**

Course Objectives:

Students undergoing this course would

- Understand different methods of 3D Printing.
- Gain knowledge about simulation of FDM process
- Estimate time and material required for manufacturing a 3D component

Syllabus		**Total Hours:42**
Module 1:		**12 Hrs**

Introduction to Prototyping, Working of 3D Printer, Types of 3D printing Machines:
Exp 1: Modelling of Engineering component and conversion of STL format.
Exp 2: Slicing of STL file and study of effect of process parameter like layer thickness, orientation, and infill on build time using software.
Exercise 1 : Component-1

Exercise 2 : Component-2

Module 2:		**10 Hrs**

Exp 1 : 3D Printing of modelled component by varying layer thickness.
Exp 2 : 3D Printing of modelled component by varying orientation.
Exp 3: 3D Printing of modelled component by varying infill.

Module 3:		**10 Hrs**

Study on effect of different materials like ABS, PLA, Resin etc, and dimensional accuracy.

Module 4:		**12 Hrs**

Identifying the defects in 3D Printed components.

Module 5		**12 Hrs**

Exp1: Modelling of component using 3D Scanner of real life object of unknown dimension in reverse engineering**.**
Exp 2: 3D Printing of above modelled component.

Course Outcomes (CO):

Upon the successful completion of course, students will be able to

- Explain different types of 3d Printing techniques
- Identify parameters for powder binding and jetting process
- Determine effective use of ABS material for 3D Printing
- Apply principles of mathematics to evaluate the volume of material require.

References:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e, World Scientific Publishers, 2003.

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Intellectual Property Rights & Patents
(Mandatory Course)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0031T	2: 0:0:0	0	CIE: 30	3Hours	MC

Course Objectives:

- This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws, Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations

Syllabus		**Total Hours:42**
UNIT - I		**12 Hrs**
Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.		
UNIT - II		**10 Hrs**
Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.		
UNIT - III		**10 Hrs**
Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.		
UNIT - IV		**12 Hrs**
Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.		
UNIT - V		**12 Hrs**
Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.		

Course Outcomes (CO):

Upon the successful completion of course, students will be able to

- Understand IPR law & Cyber law
- Discuss registration process, maintenance and litigations associated with trademarks
- Illustrate the copy right law
- Enumerate the trade secret law.

Textbooks:

1. Deborah E.Bouchoux: "Intellectual Property". Cengage learning, New Delhi
2. Kompal Bansal &Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western's Special Topics Collections

Reference Books:

1. Prabhuddha Ganguli: ' Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi
2. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
3. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
4. M. Ashok Kumar and Mohd. Iqbal Ali: "Intellectual Property Right" Serials Pub.

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Mechanical Engineering
IV B.TECH

Semester-VII (Theory–6, Skill Course–1)							
S.No.	**Course Code**	**Course Name**	**Category**	**Hours per week**			**Credits**
				L	**T**	**P**	
1.	22A0332T	**Professional Elective Course -III**	PEC	3	0	0	3
	22A0332Ta	Design of Heat Transfer Equipment					
	22A0332Tb	Tribology					
	22A0332Tc	Unconventional Machining Processes					
2.	22A0333T	**Professional Elective Course -IV**	PEC	3	0	0	3
	22A0333Ta	Refrigeration and Air-Conditioning					
	22A0333Tb	Introduction to Robotics					
	22A0333Tc	Finite Element Methods					
3.	22A0334T	**Professional Elective Course-V**	PEC	3	0	0	3
	22A0334Ta	Power Plant Engineering					
	22A0334Tb	Non-Destructive Evaluation					
	22A0334Tc	Fundamentals of Drone Technology					
4.		**Open Elective Course -III**	OEC	3	0	0	3
	22A0151T	Disaster Management					
	22A0241Ta	Smart Electric Grid					
	22A0433T	Industrial Electronics					
	22A0529T	Cloud Computing					
5.		**Open Elective Course -IV**	OEC	3	0	0	3
	22A0152T	Construction Management					
	22A0332Ta	Electric Vehicles					
	22A0432T	Basics of VLSI Design					
	22A0534Tb	Introduction to Cyber Security					
6.	22A0335T	Operations Research	PCC	2	1	0	3
7.	22A0336P	**Skill Advanced Course** Industrial Automation	SAC	1	0	2	2
8.	22A0337	**Internship-II**(Evaluated the Industry Internship completed at the end of Third year)					3
						Total	**23**

Distribution of Credits among the Category of Courses		
S.No	**Category of Courses Introduced**	**Credits Assigned**
1	Professional Core Courses (1T)	3
2	Professional Elective Courses (3T)	9
3	Open Elective Course Courses (2T)	6
4	Skill Advanced Course – 1 (T+P)	2
5	Summer Internship of completed in Third year	3
Total Credits		23

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Mechanical Engineering
IV B.TECH

Semester-VIII						
S.No.	Course Code	Course Name	Hours per week			Credits
			L	T	P	
1	22A0338	Full Internship/Project work	0	0	24	12
					Total Credits	12

Distribution of Credits among the Category of Courses		
S.No	Category of Courses Introduced	Credits Assigned
1	Project Work	12
Total Credits		12
Overall Credits in the Program		**163**

COURSES OFFERED FOR HONOURS DEGREE IN MECHANICAL ENGINEERING

Note: 1. The Honours subjects are having a total of 20 additional credits.
2. The student should acquire four credits through MOOCs compulsory to award the Honour Degree.

S.No.	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1	22A03H01	Fracture Mechanics	3	1	0	4
2	22A03H02	Computational Fluid Dynamics	3	1	0	4
3	22A03H03	Analysis and Synthesis of Mechanisms	3	1	0	4
4	22A03H04	Applications of Optimization Techniques	3	1	0	4
5	22A03H05	**MOOC**				4

LIST OF MINOR COURSES OFFERED BY MECHANICAL ENGINEERING

S.No.	Course code	Minor Title	Hours per week			Credits
1.	22A03M01	Modern Manufacturing Methods	3	1	0	4
2.	22A03M02	Engineering Thermodynamics	3	1	0	4
3.	22A03M03	Material Science & Engineering	3	0	2	4
4.	22A03M04	Design of Machine Elements	3	1	0	4
5.	22A03M05	Additive Manufacturing	3	0	2	4
6.	22A03M06	Synthesis and characterization of Composites	3	1	0	4
7.	22A03M07	Mechatronics & MEMS	3	1	0	4
8.	22A03M08	Hybrid Vehicles	3	1	0	4

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Design of Heat Transfer Equipment					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0332Ta	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To introduce basic methods of design of heat exchangers.
- To familiarize with the design procedures of various heat transfer equipment

Syllabus		**Total Hours:42**
UNIT - I	**Introduction**	**12 Hrs**

Methods of design of Heat Exchangers Concept of Logarithmic Mean Temperature Difference: Expression for single pass parallel-flow and single-pass counter flow heat exchangers – Derivation from first principles, Special Cases, LMTD for a single-pass cross-flow heat exchanger , Numerical Problems, Arithmetic Mean Temperature Difference [AMTD], Relation between AMTD and LMTD, Logical Contrast between AMTD and LMTD, LMTD of a single-pass heat exchanger with linearly varying overall heat transfer coefficient [U] along the length of the heat exchanger, Numerical problems.

Concept of Effectiveness: Effectiveness-Number of Transfer Units Approach, Effectiveness of single-pass parallel-flow and counter-flow heat exchangers, Physical significance of NTU, Heat capacity ratio, Different special cases of the above approach, Chart solutions pertaining to Effectiveness-NTU approach, Numerical problems

UNIT - II	**Design of Shell and Tube Heat Exchangers**	**10 Hrs**

Single-Pass, One shell-Two tube [1S-2T] and other heat exchangers, Industrial versions of the same, Classification and Nomenclature, Baffle arrangement, Types of Baffles, Tube arrangement, Types of tube pitch lay-outs, Shell and Tube side film coefficients, Pressure drop calculations, Numerical problems on Design of Shell and Tube Heat Exchangers

UNIT - III	**Design of Hair-Pin Heat Exchangers**	**10 Hrs**

Introduction to Counter-flow Double-pipe or Hair-Pin heat exchangers, Industrial versions of the same, Film coefficients in tubes and annuli, Pressure drop, Augmentation of performance of hair-pin heat exchangers, Series and Series-Parallel arrangements of hair-pin heat exchangers, Comprehensive Design Algorithm for hair-pin heat exchangers, Industrial standards, Numerical problems on Design of Hair-Pin Heat Exchangers.

UNIT - IV	**Design of Plate Heat Exchangers**	**12 Hrs**

Introduction, Mechanical Features – Plate pack and the frame, Plate types, Advantages and performance limits, Passes and flow arrangements, Heat transfer and pressure drop calculations, Numerical problems on Design of Plate Heat Exchangers.

UNIT - V	Design of Boilers, Condensers and Cooling Towers	12 Hrs

Boiling: types of boiling, various empirical relations pertaining to boiling, Numerical problems.

Condensation –Types of condensers, Nusselt's theory on laminar film-wise condensation, Empirical Refinements, Several empirical formulae, Numerical problems.

Cooling Towers: basic principle of evaporative cooling, classification of cooling towers, empirical relations pertaining evaporative cooling. Numerical problems on Design of Boilers, Condensers and Cooling Towers

Course Outcomes (CO):

Upon successful completion of the course, the students will be able to

- Apply LMTD and NTU methods for the design of heat exchangers.
- Design shell and tube heat exchangers used in process industries.
- Design hair-pin heat exchangers used in process industries.
- Design plate heat exchangers used in milk industries.
- Design boilers, condensers and cooling towers used in steam power plants.

Textbooks:

1. Compact Heat Exchangers, Kays, W. M. and London, A. L., McGraw – Hill, New York, 2nd Edition, 1998.
2. Fundamentals of Heat Exchanger Design, Shah, R. K. and Sekulic, D. P., John Wiley and Sons, New Jersey, 2003.

Reference Books:

1. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and Dewitt, D. P., 7th Edition, John Wiley and Sons, New York, 2013.
2. Kern, Donald Q. Process heat transfer. No. 04; QC320, K4. 1950.

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Tribology					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0332Tb	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To familiarize with the selection of lubricating system for different machine components.
- To impart knowledge on design of bearings for a given application

Syllabus		**Total Hours:42**
UNIT - I		**12 Hrs**

Basic Concepts: Oil Viscosity and temperature and pressure effect on viscosity of lubricants, viscosity index, determination of viscosity, viscosity measurements, friction and wear mechanisms- methods of fluid film formation.
Lubrication: classification of lubricant oils, characteristics of liquid, grease and solid, lubricants- additives.
Bearing Materials: Classification of bearing materials-desirable properties, advantages and applications

UNIT - II		**10 Hrs**

Hydrostatic Bearings: Introduction to hydrostatic lubrication-Viscous Flow through Rectangular Slot, Hydrostatic Bearing Analysis -Flat Circular pad, Flat square pad and Conical thrust Bearing - Energy losses and Optimum design and Temperature rise.

UNIT - III		**10 Hrs**

Hydrodynamic bearings: Principles of hydrodynamic lubrication–mechanism of pressure development in the oil-film, petroffs equation-Reynolds's equation for two-dimensional flow; hydrodynamic journal bearings-Analysis of infinitely long and infinitely short bearings- Effects of side leakage, Friction in sliding bearing heat generated and heat dissipated. Hydrodynamic thrust bearings- Analysis of plane slider bearing with fixed Pad

UNIT - IV		**12 Hrs**

Analysis of Hydrostatic Squeeze-film Lubrication: Circular plate approaching a plane - rectangular plate approaching a plane and applications of squeeze-film Lubrication
Aerostatic Bearing lubrication: Introduction, merits and demerits, applications to hydrodynamic and hydrostatic thrust bearings , externally pressurized gas bearings.
Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings –qualitative approach only.

UNIT - V		**12 Hrs**

Oil Seals &Gaskets: Different type of mechanical seals-static and dynamic, essential properties of the seals- oil flinger rings and oil grooves.
Failure of Tribological Components: Failure analysis of plain bearings, rolling bearings, gears, seals-characteristics and causes

Course Outcomes (CO):

Upon successful completion of the course, the students will be able to

- Select the appropriate lubricant and material for specific application design and analyze the hydrostatic and hydrodynamic lubrication systems used in bearings.
- Analyze and explain the hydrostatic squeeze-film lubrication, aerostatic lubrication systems used in bearings and dry rubbing bearing.
- Illustrate different types of seals and gaskets used in mechanical systems and describe the behavior of tribological components subjected to different working conditions.

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Textbooks:

1. Gwidon Stachowiak and Andrew W Batchelor, Engineering Tribology,
2. Butterworth-Heinemann, 4th Edition,2013
3. V. B. Bhandari, Design of Machine Elements,McGraw-Hill Education 4th Edition, 2013.

Reference Books:

1. H.G. Phakatkar& R.R. Ghorpade, Tribology, Nirali Prakashan.,4th Edition, 2012
2. Er. Sushil Kumar Srivastava, Tribology in Industries, S.Chand& Company Ltd, 2nd Edition, 2011
3. M.J. Neale, Tribology Handbook, Butterworth, 2nd Edition, 2001

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Unconventional Machining Processes					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0332Tc	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- Define various Modern Machining Processes.
- Acquire knowledge in the elementary mechanism and machinability of materials with different Modern Machining Processes.
- Determine basic principles of operation for each process and their applications.
- State various parameters influencing MRR in Non – Traditional Machining Process.
- Classify and understand the working of Additive Manufacturing Processes.

Syllabus		**Total Hours:42**
UNIT - I	**Non – Traditional Machining Processes**	**12 Hrs**

Introduction, Need, Classification and Brief Overview, Considerations in Process selection, Materials, Applications.

Mechanical Energy Based Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultra Sonic Machining – Working Principle, Description of Equipment, Process Parameters, Metal Removal Rate, Applications, Advantages and Limitations.

UNIT - II	**Electrical Energy Based Processes**	**10 Hrs**

Electric Discharge Machining – Working Principles, Description of Equipment, Process Parameters, Surface Finish and MRR, Electrode / Tool, Power and Control Circuits, Tool Wear, Dielectric Fluid, Flushing, Advantages, Limitations and Applications. Wire cut EDM – Working Principle and Applications.

UNIT - III	**Chemical and Electro Chemical Energy Based Processes**	**10 Hrs**

Chemical Machining and Electro Chemical Machining – Working Principle, Description of Equipment, Etchants, Maskants, Techniques of Applying Maskants, Process Parameters, Surface Finish and MRR, Electro Chemical Grinding, Electro Chemical Honing, Applications, Advantages and Limitations

UNIT - IV	**Thermal Energy Based Processes:**	**12 Hrs**

Laser Beam Machining and Drilling, Plasma Arc Machining, Electron Beam Machining – Working Principle, Description of Equipment, Process Parameters, Applications, Advantages and Limitations.

UNIT - V	**Additive Manufacturing**	**12 Hrs**

Introduction to Additive Manufacturing, Classification of Additive Manufacturing Processes, Working Principle, Advantages, Limitations and Applications of Sterolithography (SLA), Fused Deposition Modeling, Selective Laser Sintering, Laminated Object Manufacturing

Course Outcomes (CO):

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

- Illustrate advanced machining processes, cutting tools and cutting fluids for a specific material and part features.
- Classify the mechanism of Mechanical Energy based machining processes, its applications and limitations.
- Differentiate Electrical Energy Based machining processes, mechanism of metal removal, machine tool selection.
- Interpret Electro Chemical machining process, economic aspects of ECM and problems on estimation of metal removal rate.

Textbooks:

1. Jain V.K., Advanced Machining Processes, 1st Edition, Allied Publishers Pvt. Ltd., New Delhi, 2007.
2. Pandey P.C and Shan H.S., Modern Machining Processes, 1/e, McGraw Hill, New Delhi, 2007.
3. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.

Reference Books:

1. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e, World Scientific Publishers, 2003.
2. Benedict G.F., Nontraditional Manufacturing Processes, 1/e, CRC Press, 1987.
3. Mishra P.K., Nonconventional Manufacturing, 1/e, Narosa Publishing House, New Delhi, 2014.
4. McGeough J.A., Advanced Methods of Machining, 1/e, Springer, 1988.

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Refrigeration and Air Conditioning					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0333Ta	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To introduce the basic cycles of various refrigeration systems, their performance evaluation along with details of system components and refrigerants used.
- To impart knowledge on psychrometric properties and processes and design of air-conditioning systems

Syllabus		**Total Hours:42**
UNIT - I		**12 Hrs**

Introduction: Need and Applications of refrigeration, Unit of refrigeration and C.O.P, Methods of refrigeration.

Aircraft Refrigeration: Refrigeration needs of Aircrafts - Air craft refrigeration systems - working and their analysis.

Thermoelectric Refrigeration: Working principle and applications.

UNIT - II		**10 Hrs**

Vapor Compression Refrigeration: Working principle and essential components of the plant, actual cycle, effect of sub-cooling, super-heating, evaporator and condenser pressures on system performance – use of p-h charts.

Refrigerants: Desirable properties, classification, Nomenclature, application, Ozone Depletion, Global Warming.

UNIT - III		**10 Hrs**

VCR System Components: Classification and working of Compressors, Condensers, Evaporators and Expansion devices.

Vapor Absorption System: Description and working of NH3 – water system,Calculation of maximum COP and Description and working of Li Br –water (Two shell) System, Requirements of refrigerant and absorbent.

UNIT - IV		**12 Hrs**

Psychrometry & Psychrometric Processes: Review of Psychrometric Properties, Psychometric Processes: Sensible heating, sensible cooling, humidification and de-humidification, cooling and de-humidification, cooling with adiabatic humidification, heating and humidification, adiabatic mixing of two air streams.

UNIT - V		**12 Hrs**

Design of Air-Conditioning Systems: Characterization of Sensible and latent heat loads, Need for Ventilation, Consideration of Infiltration, Load concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP. Comfort Air conditioning - summer air conditioning, winter air conditioning, Air conditioning Load Calculations.

Course Outcomes (CO):

Upon successful completion of the course, the students will be able to

- Analyze different kinds of aircrafts refrigeration systems and illustrate the working of thermoelectric refrigerator.
- Analyze single stage vapor compression refrigeration systems and select a suitable refrigerant for a given application.
- Classify VCR system components and illustrate the working of various types of vapour absorption refrigeration systems.
- Estimate the psychrometric properties and analyze various psychrometric processes.
- Estimate the cooling/heating loads on the air-conditioning equipment for a given application

Textbooks:

1. C P Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill Education, 3rd edition.
2. S C Arora & Domkundwar, "A Course in Refrigeration and Air conditioning", Dhanpat Rai publications, 5th edition.
3. 3. Manohar Prasad, "Refrigeration and Air Conditioning", New Age publications, Revised 2nd edition.

Reference Books:

1. Dossat, "Principles of Refrigeration", Pearson Education.
2. Anantha Narayanan, "Basic Refrigeration and Air-Conditioning", Tata McGraw- Hill Education, 4th edition.

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Introduction to Robotics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0333Tb	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- The objectives of this course are Identify robots and its peripherals for satisfactory operation and control of robots for industrial and non-industrial applications.

Syllabus		**Total Hours:42**
UNIT - I	**Robot Basics**	**12 Hrs**

Automation and Robotics: Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision, accuracy, repeatability, work and volume of robot.

UNIT - II	**Robot Elements**	**10 Hrs**

End effectors-Classification- Types of Mechanical actuation, Gripper design, Robot drive system Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation

UNIT - III	**Robot Kinematics And Control**	**10 Hrs**

Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control, Robot programming

UNIT - IV	**Robot Sensors**	**12 Hrs**

Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.

UNIT - V	**Robot Applications**	**12 Hrs**

Industrial applications of robots-Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications.

Course Outcomes (CO):

On completion of the course the student will be able to:

- List and explain the basic elements of industrial robots
- Analyse robot kinematics and its control methods.
- Classify the various sensors used in robots for better performance.
- Summarize various industrial and non-industrial applications of robots

Textbooks:

1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, “Industrial Robotics Technology,
2. Programming and Applications”, Tata –McGraw Hill Pub. Co., 2008.
3. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.

Reference Books:

1. Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering: An Integrated Approach"', Prentice Hall of India Pvt. Ltd., 1994.
2. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, "Robotics control, sensing, vision and intelligence", Tata- McGraw Hill Pub. Co., 2008
3. Yu. "Industrial Robotics", MIR Publishers Moscow, 1985

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Finite Element Method					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0333Tc	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To familiarize with the concepts of finite element method for structural , thermal and dynamic analysis

Syllabus		**Total Hours:42**
UNIT - I		**12 Hrs**

Introduction: stress and equilibrium, strain – displacement relations, stress – strain relations, variational and weighted residual methods.
Finite Element Method: Introduction to finite element methods, steps in finite element method applications, advantages and disadvantages of finite element method.

One Dimensional Bar Problems: 1-D bar element - shape functions – stiffness matrix and load vector– assembly of matrices – treatment of boundary conditions-One dimensional quadratic element.

UNIT - II		**10 Hrs**

Analysis of Trusses: Local and global coordinate systems, transformation matrix , element stiffness matrix , determination of displacements and stresses **Analysis of Beams:** Beam element - shape functions and element stiffness matrix, load vector , determination of deflections , support reactions

UNIT - III		**10 Hrs**

Two Dimensional Problems: Plane stress and plane strain problems , constant strain triangle(CST) element – shape functions , Jacobian of transformation, strain displacement matrix , element stiffness matrix , determination of deflections and stresses.

Isoparametric Formulations: Coordinate transformation, sub,iso and super parametric elements, iso parametric formulations of bar element, quadrilateral element, numerical integration – Gaussian quadrature approach.

UNIT - IV		**12 Hrs**

Steady State Heat Transfer Analysis: 1- D steady state thermal analysis of plane and composite walls, analysis of a fin.

UNIT - V		**12 Hrs**

Dynamic Analysis: Free longitudinal and transverse vibrations, eigen values and eigen vectors , natural frequencies for bars and beams.

Course Outcomes (CO):

Upon successful completion of the course, the students will be able to

- Apply variational and weighted residual methods to solve differential equations.
- Determine the stresses and strains in one dimensional bar problems.
- Analyze trusses and beams to determine the stresses induced.
- Determine the displacements and stresses in 2d problems.
- Develop iso parametric formulations for finite elements and solve them using Numerical techniques.
- Analyze 1-d heat transfer problems to determine rate of heat transfer and Temperature distribution.
- Determine natural frequencies of vibrating systems using finite element method.

Textbooks:

1. Chandragupta, Ashok and Belaunde , "Introduction to Finite Elements in Engineering ", Prentice – Hall,2011
2. Daryl L Logan, "A first course in finite element method", Cengage Learning. 2011.

Reference Books:

1. Robert D Cook, "Finite element modeling for stress analysis ", John wily & Sons.
2. SS Rao , "The Finite Element Methods in Engineering", Elsevier Science,5th Edition, 2011.
3. JN Reddy, "An introduction to Finite Element Method", McGraw Hill Education, 2006.
4. S.S. Bhavikatti ," Finite Element Analysis", New Age International Pvt Ltd , 2015.

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Power Plant Engineering					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0334Ta	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To introduce the working of various power plants.
- To familiarize with power plant effluents and power plant economics.

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to the Sources of Energy**	**12 Hrs**

Resources and Development of Power in India. **Steam Power Plant:** Plant Layout, Components, Working of different Circuits.

Coal Handling Systems: Types of fuels, Coal handling, Choice of coal handling equipment

UNIT - II	**Combustion Process**	**10 Hrs**

Methods of Coal firing, Overfeed and Underfeed stoker firing - Principles and types of stoker firing systems, Pulverized fuel firing - Principle, Types of burners and Mills, Fluidized Bed Combustion, Cyclone Burner.

Ash and Dust handling: Types of Ash handling systems, Working principles of various Dust collectors.

Cooling towers: Types of Cooling towers and their working.

UNIT - III	**Cogeneration**	**10 Hrs**

Working principles, Combined stem and gas turbine plants, Combined gas and diesel power plants, limitations.

Hydroelectric Power Plant: Water power, Hydrological cycle, Hydrographs, Flow duration curve, Mass curve. Hydroelectric Power plant layout with auxiliaries, classification of dams, spill ways and surge tanks.

UNIT - IV	**Nuclear Power Plant**	**12 Hrs**

Nuclear fusion and fission, working of nuclear plant, Components of Nuclear Reactor, Classification of reactors, Pressurized water reactor, Boiling water reactor, Gas cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal.

UNIT - V	**Environmental Aspects of Power Generation**	**12 Hrs**

Effluents from power plants and their impact on environment, Pollutants and Pollution standards, Methods of Pollution control.

Load Calculations: Load curves, load duration curve, definitions of connected load, maximum demand, demand factor, average load, load factor, diversity factor – related exercises.

Course Outcomes (CO):

Upon successful completion of the course, the students will be able to

- Illustrate working of different circuits, and coal handling systems of steam Power plant.
- Describe the methods of coal firing, ash handling systems and cooling towers in steam power plant.
- Understand the working of hydraulic and combined operations of power plants .
- Explain the working of nuclear power plant.
- Familiarize with the power plant effluents, economics and their control.

Textbooks:

1. G.D. Rai, "An Introduction to Power Plant Technology", Khanna Publishers, 2006, 5th Edition.
2. P.K.Nag, "Power Plant Engineering", Tata McGraw-Hill Education, 2008, 3rd Edition

Reference Books:

1. S.C. Arora and S. Domkundwar "A Course in Power Plant Engineering",
2. Dhanpat Rai & Co. (P) Limited, 2004, 5th edition.
3. R. K. Rajput, "A Text Book of Power Plant Engineering", Laxmi Publications(p) Ltd. 2009, 4th Edition.
4. M.M.El-Wakil, "Power Plant Technology", Tata McGraw-Hill Education, Revised 2nd edition.
5. R.K Hedge " Power plant Engineering " Pearson India Education service Limited, 2016, 2nd edition.

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Non-Destructive Evaluation					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0334Tb	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

- To familiarize with the concepts of various NDT techniques to identify the defect in a mechanical component

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to NDT and Radiography Test**	**12 Hrs**

Introduction: Overview of non-destructive testing, types of materials testing, Preliminary NDT methods, NDT methods

Radiography test: Sources of X rays and Gamma Rays, their properties and interaction with matter, radiographic test, film characteristics, radiographic equipment, Radiographic techniques, safety aspects, advantages, limitations, industrial applications of radiography test.

UNIT - II	**Ultrasonic Test**	**10 Hrs**

Principle of wave propagation, piezo-electric effect, ultrasonic transducers - characteristics, ultrasonic equipment, testing procedure, interpretation, evaluation, advantages, limitations, industrial applications of ultrasonic testing

UNIT - III	**Liquid Penetrant Test**	**10 Hrs**

Basic concepts, liquid penetrant system, surface preparation, test procedure, examination, interpretation, evaluation, advantages, limitations, industrial applications of liquid penetrant testing.

UNIT - IV	**Magnetic Particle Test**	**12 Hrs**

Magnetic materials, principle of magnetic particle test, magnetic particle test equipment, test procedure, interpretation and evaluation, advantages, limitations, Industrial applications of the magnetic particle test.

UNIT - V	**Eddy Current Test**	**12 Hrs**

Principle of eddy current, factors affecting eddy currents, impedance diagram, eddy current test system, test coils, advantages, limitations and industrial applications of eddy current test.

Course Outcomes (CO):

Upon successful completion of the course, the students will be able to

- Describe choose a suitable non-destructive method to find the defect in the given mechanical components using radiography test, ultrasonic test, liquid penetrant test, magnetic particle test and eddy current test

Textbooks:

1. J Prasad and GCK Nair, “Non-Destructive Test and Evaluation of Materials”, Tata McGraw-Hill Education, 2nd edition, 2011.
2. B Raj, T Jayakumar and M Thavasimuthu, “Practical Non Destructive Testing”,
3. Alpha Science International Limited, 3rd edition, 2017.

Reference Books:

1. V Jayakumar and K Elangovan, “Non-Destructive Testing of Materials”, Lakshmi Publications, 2nd edition, 2018.
2. George V. Crowe, “An Introduction to Nondestructive Testing”, American Society for Nondestructive Testing, 3rd edition, 2009.
3. Ravi Prakash, “Non-Destructive Testing Techniques”, New age international publishers, 1st edition, 2021.

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Fundamentals of drone technology					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0334Tc	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PEC**

Course Objectives:

The course should enable the students to:

- To make the students to understand the basic concepts of UAV drone systems.
- To introduce the stability and control of an aircraft

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to Drones**	**12 Hrs**

Introduction to Unmanned Aircraft Systems, History of UAV drones, classification of drones, System Composition, applications

UNIT - II	**Design of UAV Drone Systems**	**10 Hrs**

Introduction to Design and Selection of the System, Aerodynamics and Airframe Configurations, Characteristics of Aircraft Types, Design Standards and Regulatory Aspects-India Specific, Design for Stealth.

UNIT - III	**Avionics Hardware of Drones**	**10 Hrs**

Autopilot, AGL-pressure sensors servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration.

UNIT - IV	**Communication, Payloads and Controls**	**12 Hrs**

Communication, Payloads and Controls: Payloads, Telemetry, Tracking, controls-PID feedback, radio control frequency range, modems, memory system, simulation, ground test-analysis-trouble shooting

UNIT - V	**Navigation and Testing**	**12 Hrs**

Navigation and Testing: Waypoints navigation, ground control software, System Ground Testing, System In-flight Testing, Future Prospects and Challenges

Course Outcomes (CO):

The student should able to:

- Ability to design UAV drone system
- To understand working of different types of engines and its area of applications.
- To understand static and dynamic stability dynamic instability and control concepts
- To know the loads taken by aircraft and type of construction and also construction materials used in Drones

Textbooks:

1. Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
2. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
3. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007

Reference Books:

1. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998.
2. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics.

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Disaster Management					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0151T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The course should enable the students to:

- To make the students to understand the basic concepts of UAV drone systems.
- To introduce the stability and control of an aircraft

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to Drones**	**12 Hrs**
Introduction to Unmanned Aircraft Systems, History of UAV drones, classification of drones, System Composition, applications		
UNIT - II	**Design of UAV Drone Systems**	**10 Hrs**
Introduction to Design and Selection of the System, Aerodynamics and Airframe Configurations, Characteristics of Aircraft Types, Design Standards and Regulatory Aspects-India Specific, Design for Stealth.		
UNIT - III	**Avionics Hardware of Drones**	**10 Hrs**
Autopilot, AGL-pressure sensors servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration.		
UNIT - IV	**Communication, Payloads and Controls**	**12 Hrs**
Communication, Payloads and Controls: Payloads, Telemetry, Tracking, controls-PID feedback, radio control frequency range, modems, memory system, simulation, ground test-analysis-trouble shooting		
UNIT - V	**Navigation and Testing**	**12 Hrs**
Navigation and Testing: Waypoints navigation, ground control software, System Ground Testing, System In-flight Testing, Future Prospects and Challenges		

Course Outcomes (CO):

The student should able to:

- Ability to design UAV drone system
- To understand working of different types of engines and its area of applications.
- To understand static and dynamic stability dynamic instability and control concepts
- To know the loads taken by aircraft and type of construction and also construction materials used in Drones

Textbooks:

1. Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
2. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
3. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007

Reference Books:

1. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998.
2. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics.

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Smart Electric Grid (Common to all Except EEE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0241Ta	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The course should enable the students to:

- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering and protocols for smart metering
- Power quality management with upgraded technologies.

Syllabus		**Total Hours: 48**
Unit-I	**Introduction to Smart Grid**	**10 Hrs**
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives**.**		
Unit-II	**Smart Grid Technologies**	**8 Hrs**
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).		
Unit –III	**Smart Meters**	**10 Hrs**
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.		
Unit -IV	**Power Quality Management in Smart Grid**	**10 Hrs**
Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.		
Unit –V	**High Performance Computing**	**10 Hrs**
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN),Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.		

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concepts and design of Smart grid.
- Understand the various communication technologies in smart grid.
- Understand the various measurement technologies in smart grid.
- Understand the analysis and stability of smart grid.
- Learn the renewable energy resources and storages integrated with smart grid.
- familiarize the high performance computing for Smart Grid applications

Textbooks:

1. Smart Grid, Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012, Reprint 2015.
2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press., 2012, Reprint 2016.

Reference Books:

1. The Smart Grid – Enabling Energy efficiency and demand response, Clark W. Gellings, P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Smart Grid – Applications, Communications, and Security Edited by Lars Torsten Berger, Krzysztof Iniewski, WILEY, 2012, Reprint 2015.
3. Practical Electrical Network Automation and Communication Systems, Cobus Strauss, ELSVIER, 2003

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Industrial Electronics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0433T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The course should enable the students to:

- Describe semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries.
- Describe the ultrasonic and its application.

Syllabus		**Total Hours: 48**
Unit-I	**Industrial Electronics**	**10 Hrs**

Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semi conductor, Open circuited p-n junction, Diode resistance, Zener diode, Photo conductors and junction photo diodes, Photo voltaic effect, Light emitting diodes(LED).

Unit-II	**Transistor**	**8 Hrs**

Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor-α, Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

Unit –III	**AC to DC converters**	**10 Hrs**

AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period .Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

Unit -IV	**Resistance welding controls**	**10 Hrs**

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, Electronic welding control used in Resistance welding, Energy storage welding. Induction heating: Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. Dielectric heating: Principle of

dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

Unit –V	**Ultrasonics**	**10 Hrs**

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physio-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the semi-conductor devices and their switching characteristics.
- Apply the Ultrasonic waves with different applications.
- Understand the working of Transistor and its different configurations.
- Analyze the thermal effects of ultrasonic, soldering and welding by ultrasonic, ultrasonic Drying in the industry; interpret the characteristics of AC to DC converters.
- Develop the practical applications Electronics in industries.
- Apply the process of Resistance welding, Induction heating and Dielectric heating in the industry.

Textbooks:

1. Fundamentals of Industrial Electronics, Bogdan M Wilamowski, J David irwin, 2nd Edition, 2011.
2. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
3. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972.

Reference Books:

1. Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edn., 2003.
2. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE

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Cloud Computing					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0529T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The course should enable the students to:

- To introduce the broad perceptive of cloud architecture and model
- To understand the concept of Virtualization and familiar with the lead players in cloud.
- To understand the features of cloud simulator and apply different cloud programming model
- To design of cloud Services and explore the trusted cloud Computing system

Syllabus		**Total Hours:48**
Module-I	**Basics of Cloud Computing**	**10Hrs**

Introduction to Cloud: Introduction to Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Elasticity in Cloud, On-demand Provisioning.

Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization, and Cloud computing.

Module-II	**Cloud Architecture, Models and Security**	**9Hrs**

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds.

Cloud Deployment Model: Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud.

Module-III	**Cloud Technologies and Advancements**	**10Hrs**

Apache Hadoop, MapReduce, Hadoop Cluster setup, Virtual Box, Google App Engine, Programming Environment for Google App Engine – Open Stack

Module-IV	**VMware Simulator**	**9Hrs**

VMWare: Basics of VMWare, Advantages of VMware virtualization, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Module-V	**Cloud Applications**	**10Hrs**

Cloud Applications: Scientific Applications – Health Care, Geoscience.
Business And Consumer Applications - CRM and ERP, Social Networking, Media Applications, and Multiplayer Online Gaming.

Course Outcomes (CO):

On completion of this course, student will be able to

- To Understand the basic concepts about cloud computing vision and its developments and gain the Knowledge of virtualization technology.
- Analyze the concepts of cloud services and the deployment models.
- Choose among various cloud technologies for implementing applications (GAE, Open stack ,etc)
- Construct the virtual machines by using VMware simulator.
- Build scientific applications by using Cloud environment.
- Develop Business and Consumer Applications.

Textbooks:

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly
3. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010.

Reference Books:

1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O 'Reilly, SPD, rp2011.
5. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.

Web Resources:

1. https://nptel.ac.in/courses
2. https://freevideolectures.com/university/iitm

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Construction Management					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0152T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The course should enable the students to:

- To make the student familiar with various construction activities, preparing construction schedule and maintaining documents and records of those activities
- To teach the students about various terms and technologies involved in earthwork of construction activities
- To make the students familiar with concepts involved in project management like bar charts and milestone charts
- To teach the students the concepts of time estimates involved in CPM and PERT , float and slack, critical path calculations

Syllabus		**Total Hours:42**
UNIT - I	**Fundamentals Of Construction Technology**	**12 Hrs**

Definitions and Discussion – Construction Activities –Construction Processes -Construction Works – Construction Estimating – Construction Schedule – Productivity and Mechanized Construction – Construction Documents – Construction Records – Quality – Safety – Codes and Regulations.

UNIT - II	**Earthwork**	**10 Hrs**

Classification of Soils – Project Site – Development – Setting Out - Mechanized Excavation – Groundwater Control – Trenchless (No-dig) Technology – Grading – Dredging.Rock Excavation – Basic Mechanics of Breakage – Blasting Theory – Drillability of Rocks – Kinds of Drilling – Selection of the Drilling Method and Equipment – Explosives – Blasting Patterns and Firing Sequence – Smooth Blasting – Environmental Effect of Blasting

UNIT - III	**Project Management and Bar Charts And Milestone Charts**	**10 Hrs**

Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives Operation research – Methods of planning and programming problems – Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts

UNIT - IV	**Elements of Network and Development Of Network**	**12 Hrs**

Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles Problems

UNIT - V	**PERT and CPM**	**12 Hrs**

Time estimates – Frequency distribution – Mean, variance and standard deviation-Expected time Problems -Earliest expected time – Formulation for TE - Latest allowable occurrence time – Formulation for TL - Combined tabular computations for TE and TL problems. Introduction - Slack – Critical path-Illustrative examples Problems

Course Outcomes (CO):

On completion of this course, student will be able to

- Identify the various construction activities like preparing construction schedule and maintaining documents and records of those activities
- Understand the concepts and techniques involved in earthwork activities• To understand about the emerging infectious diseases and aids their management
- Understand the steps involved in developing a project scheduling and management and the application of bar charts and milestone charts.
- Understand the various elements of a network diagram like event, activity and dummy.
- Understand the concepts of calculation of time estimates of CPM and PERT

Textbooks:

1. Construction project management by Jha ,Pearsonpublications, New Delhi 2nd Edition 2015
2. Construction Technology by SubirK.Sarkar and SubhajitSaraswati – Oxford Higher EducationUniv.Press, Delhi 2008 edition
3. Project Planning and Control with PERT and CPM by Dr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi 2022 editionDelhi

1. **Reference Books:**

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing house 2003.
2. Total Project management, the Indian context- by : P.K.JOY- Mac Millan Publishers India Limited.

E-resources:

1. https://nptel.ac.in/courses/105104161

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Electric Vehicles (Common to all Except EEE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0232Ta	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The course should enable the students to:

- Understand to Provide good foundation on hybrid and electrical vehicles.
- Understand To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles
- Familiarize energy storage systems for electrical and hybrid transportation
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.

Syllabus		**Total Hours: 50**
Module-I	**Electric Vehicle Propulsion and Energy Sources**	**10Hrs**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

Module-II	**Electric Vehicle Power Plant And Drives**	**10 Hrs**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives PWM, current control method. Switch reluctance machine drives - voltage control, current control.

Unit -III	**Hybrid And Electric Drive Trains**	**9 Hrs**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

Unit -IV	**Electric and Hybrid Vehicles - Case Studies**	**11 Hrs**

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

Unit -V	**Electric And Hybrid Vehicle Design**	**10 Hrs**

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the working of hybrid and electric vehicles
- Apply a suitable drive scheme for developing an hybrid and electric vehicles depending on resources
- e Develop the electric propulsion unit and its control for application of electric vehicles.
- Understand the proper energy storage systems for vehicle applications
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles

Textbooks:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.

Reference Books:

1. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, WileyBlackwell, 2018.

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Basics of VLSI Design					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0432T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The course should enable the students to:

- To give exposure to different steps involved in fabrication Process of PMOS & NMOS transistors, CMOS & BICOM Inverters.
- To provide knowledge on electrical properties of MOS & BICMOS devices to analyze the behaviour of inverters designed with various loads.
- To provide knowledge on Basic Circuit Concepts of VLSI Design
- To apply the design Rules and draw layout of a given logic circuit and basic circuit concepts to MOS circuits.
- To Apply the design for testability methods for combinational & sequential CMOS circuits

Syllabus		**Total Hours: 50**
Module-I	**Introduction to Fabrication Process**	**10Hrs**

Introduction: Brief Introduction to IC technology, Moore's Law, Different modes MOSFET operation, Fabrication Process of PMOS, NMOS, CMOS & Bi-CMOS devices, Comparison between CMOS and Bi-polar Technologies.

Fabrication Steps: Wafer Preparation, Oxidation, Photolithography, Etching, Ion Implantations, Metallization, Testing.

Module-II	**Basic Electrical Properties of MOS/BiCMOS devices**	**10 Hrs**

Basic Electrical Properties: Ids Vs Vds relationships, MOS transistor Threshold Voltage-VT, figure of merit-ω0, Transconductance - gm, Output conductance-gds, Pass transistor logic, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, and through one or more pass transistors Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Unit -III	**Basic Circuit Concepts**	**9 Hrs**

Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

Unit -IV	**VLSI Circuit Design Processes**	**11 Hrs**

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters Logic Gates and Various MOS Circuits. Scaling of MOS circuits, Limitations of Scaling.

Unit -V	CMOS Testing	10 Hrs

CAD Tools for Design and Simulation, Aspects of Design Tools, Design for Testability, Testing Combinational Logic, Testing Sequential Logic, Practical Design for Test (OFT) Guidelines, Scan Design Techniques, Built-In-Self-Test (BIST), Future Trends.

Course Outcomes (CO):

On completion of this course, student will be able to

- Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.
- Understand the concept of Basic Electrical Properties of MOS/Bi-CMOS Devices
- Apply the basic circuit concepts to MOS circuits.
- Understand the concept of Scaling of MOS circuits and Limitations of Scaling
- Apply the design Rules to draw the Stick diagram &layout of a given logic circuit.
- Interpret the need for testability and testing methods in VLSI.

Textbooks:

1. Kamran Eshraghian, “Essentials of VLSI Circuits and Systems”, Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Behzad Razavi , “Design of Analog CMOS Integrated Circuits”, McGraw Hill, 2003
3. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

Reference Books:

1. Jan M. Rabaey, “Digital Integrated Circuits”, AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.
2. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, John Wiley & Sons, reprint 2009
3. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.

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Introduction to Cyber Security					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0534b	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**OEC**

Course Objectives:

The course should enable the students to:

- The Cyber security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
- Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.
- Evaluate the trends and patterns that will determine the future state of cyber security.

Syllabus		**Total Hours:48**
Module-I	**Introduction to Cybercrime**	**9 Hrs**
Introduction to Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens		
Module-II	**Cyber Offenses**	**10 Hrs**
How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Backdoors-Steganography-SQL Injection.		
Module-III	**Cybercrime Mobile and Wireless Devices**	**9 Hrs**
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile.		
Module-IV	**Tools and Methods Used in Cybercrime**	**10Hrs**
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, DoS and DDoS Attacks, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).		
Module-V	**Cyber Crimes and security**	**10Hrs**
Cyber Security –Organizational implications-cost of cybercrimes and IPR issues Web threats for organizations: the evils and Perils-Social media marketing Security and privacy Implications-Protecting people privacy in the organizations Forensic best practices for organizations. Cases.		

Course Outcomes (CO):

On completion of this course, student will be able to

- Cyber Security architecture principles
- Identifying System and application security threats and vulnerabilities
- Identifying different classes of attacks
- Cyber Security incidents to apply appropriate response
- Describing risk management processes and practices

Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning

Reference Books:

1. Information Security, Mark Rhodes, Ousley, MGH.

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Operations Research					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0335T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To impart the basic concepts of modelling, models and statements of the operations research.
- Formulate and solve linear programming problem/situations.
- Model strategic behavior in different economic situations.
- To solve transportation problems to minimize cost.
- Apply Queuing theory to solve problems of traffic congestion, counters in banks, railway bookings etc.
- Explain scheduling and sequencing of production runs and develop proper replacement policies

Syllabus		**Total Hours:42**
UNIT - I	**Introduction to OR**	**12 Hrs**

Introduction to Operations Research (OR): OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models

Linear Programming(LP): Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem

UNIT - II	**Transportation and Assignment Problems**	**10 Hrs**

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution –North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, Degenerate Problem. Assignment Problem – Formulation, Hungarian Method for Solving Assignment Problems, Traveling Salesman problem.

UNIT - III	**Game theory & Job Sequencing**	**10 Hrs**

Game theory: Optimal solution of two person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies. Reduction by principles of dominance, arithmetic, algebraic method and graphical method.

Job Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Job Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method

UNIT - IV	**Queuing Theory & Inventory Control**	**12 Hrs**

Queuing Theory: Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with infinite and finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with infinite queue length.

Inventory Control: Introduction, Deterministic models – EOQ model with and without shortages, Production model, Buffer stock and discount inventory models with single price breaks. Selective inventory control.

UNIT - V	Replacement and Maintenance Analysis & DP	12 Hrs

Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Dynamic Programming (DP): Introduction –Bellman's Principle of Optimality – Applications of Dynamic Programming – Shortest Path Problem – Capital Budgeting Problem Solution of Linear Programming Problem by DP

Course Outcomes (CO):

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

- Develop mathematical models for practical problems. (L3)
- Apply linear programming to transportation problems. (L3)
- Solve games using various techniques. (L3)
- Solve production scheduling and develop inventory policies. (L6)
- Apply optimality conditions for constrained and unconstrained nonlinear problems. (L3)
- Apply dynamic programming methods. (L3)

Textbooks:

1. Sharma S.D., Operations Research: Theory, Methods and Applications, 15/e, Kedar Nath Ram Nath, 2010
2. Taha H.A., Operations Research, 9/e, Prentice Hall of India, New Delhi, 2010.

Reference Books:

1. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7/e, Tata McGraw Hill, 2010.
2. Sharma J.K., Operations Research: Theory and Applications, 4/e, Laxmi Publications, 2009.
3. Prem kumar Gupta and Hira, Operations Research, 3/e, S Chand Company Ltd., New Delhi, 2003.
4. Pannerselvam R., Operations Research, 2/e, Pentice Hall of India, New Delhi, 2006.
5. Sundaresan.V, and Ganapathy Subramanian.K.S, Resource Management Techniques: Operations Research, A.R Publications, 2015.

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Industrial Automation					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0336P	**1: 0:2:0**	**2**	**CIE: 30 SEE:70**	**3Hours**	**SAC**

Course Objectives:

- Introduce basic concepts and principles of Industrial Automation.
- Familiarize with fluid power systems circuits.
- Describe concepts of SCADA software
- Explain the principles of PLC and 8085 microprocessor.
- Expose the students on Mechatronics.

Syllabus	**Total Hours:42**
Module 1:	**12 Hrs**

Design and testing of fluid power circuits to control
Introduction to Fluid power systems, Symbolic representation of hydraulic and pneumatic components.

Tasks:-

1. Pneumatic trainer kit with FRL Unit, Single acting cylinder, push button.
2. Pneumatic training kit with FRL unit, Double acting cylinder, manually actuated DCV.
3. Pneumatic trainer kit with FRL unit, Double acting cylinder, Pilot actuated DCV.
4. Pneumatic trainer kit with FRL unit Double acting cylinder, Double solenoid actuated DCV, DCV with sensor / magnetic reed.
5. Hydraulic power pack with pumps and pressure relief valve.

Module 2:	**10 Hrs**

1. Open source SCADA software such as Free SCADA, Open SCADA,
2. Indigo SCADA Code Sys Open source for PLC programming and interfacing with real time PLC
3. Delta PLC software – free ware and corresponding PLC programming software.
4. 8085 Microprocessor Trainer with Power Supply
5. Traffic Light Control System

Module 3	**10 Hrs**

Mechatronics

1. Experiment on P, PI and PID Controller.
2. Simulation of Hydraulic Actuation System.
3. Simulation of Pneumatic Actuation System.
4. Simulation on Stepper Motor.
5. Simulation on Logic gates, decoders and flip-flops.

References:

1. B. Gavali, S. A. Patil and A. R. Koli, "Technology-Based Learning system in Programmable Logic Controller Education," 2016 IEEE Eighth International Conference on Technology for Education (T4E), Mumbai, 2016, pp. 264-265.
2. Groover, Mikell , Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 2014.
3. Lamb, Frank. Industrial Automation: Hands On (English Edition). NC, McGraw-Hill Education, 2013. ISBN 978-0071816458

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Fracture Mechanics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A03H01	**3: 1:0:0**	**4**	**CIE: 30 SEE:70**	**3Hours**	**HCC**

Course Objectives:

- To familiarize with the basic concepts of fracture mechanics and its applications

Syllabus		**Total Hours:60**
UNIT - I		**12 Hrs**

Introduction: History and over view, fracture mechanics approach to design, effect of material properties on fracture.

Fracture Mechanisms: Ductile fracture, cleavage, ductile-brittle transition, intergranular fracture, environment assisted cracking.

Linear Elastic Fracture Mechanics: Griffith energy balance, energy release rate, crack resistance, R curve, stable and unstable crack growth.

UNIT - II		**12Hrs**

Stress Analysis of Cracks: Modes of fracture - opening , sliding and shearing mode , Airy stress function , crack tip stress field using Westergaurd approach,effect of finite size , relation between stress intensity factor and energy release rate.

UNIT - III		**12 Hrs**

Crack Tip Plastic Zone: Plastic zone shape, Irwin plastic zone correction, Dugdale approach, shape of the plastic zone, plastic constraint factor, thickness effect.

UNIT - IV		**12 Hrs**

Elastic-Plastic Fracture Mechanics: Crack-tip-opening displacement, *J* contour integral, relationships between *J* and CTOD, crack-growth resistance curves, *J*controlled fracture.

UNIT - V		**12 Hrs**

Test Methods: Introduction, KIc-test technique, test methods to determine JIc,test methods to determine GIc AND GIIc, determination of critical CTOD.

Crack Detection Through Non-Destructive Testing: Introduction, examination through human senses, liquid penetration inspection, ultrasonic testing, radiographic imaging, magnetic particle inspection.

Textbooks:

1. T. L. Anderson, Fracture Mechanics: Fundamentals and Applications, CRC Press, 3rd edition
2. Prashant Kumar, Elements Of "Fracture Mechanics, Mcgraw Hill Education, First edition.

Reference Books:

1. David Broek, Elementary engineering fracture mechanics, Kluwer Academic Publishers, 4th edition
2. J.F. Knott, P Withey, Worked examples in Fracture Mechanics, Institute of Materials, 2nd Edition

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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NELLORE – 524137 (A.P) INDIA

Computational Fluid Dynamics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A03H02	**3: 1:0:0**	**4**	**CIE: 30 SEE:70**	**3Hours**	**HCC**

Course Objectives:

- To solve fluid flow/ heat transfer problems by the application of finite difference and finite volume methods.

Syllabus		**Total Hours:60**
UNIT - I		**12 Hrs**

Governing equations of fluid dynamics and Heat Transfer: Models of the flow, substantial derivative, continuity equation, the momentum equation, the energy equation, initial and boundary conditions.

Classification of partial Differential Equations: Introduction, Classification of partical differential equations - Cramer's rule, Eigen value method

UNIT - II		**12Hrs**

Basic Aspects of Discretization: Introduction to Finite Differnece approach, Difference Equations. Finite difference in non-uniform grid, Types of errors, consistency, stability, convergence. Solution Techniques for System of Algebraic Equations: Direct Methods, Cramer's rule, matrix inversion, Gaussian elimination, Tri-diagonal matrix algorithm (TDMA). Iterative method: Gauss-Jacobi, Gauss -Seidel.

UNIT - III		**12 Hrs**

Finite Difference Method for Diffusion Problems: Formulation for one dimensional steady and unsteady diffusion equation - Explicit Scheme, Crank-Nicolson Sceheme, Fully Implicit Scheme.

UNIT - IV		**12 Hrs**

Finite Volume Method for Diffusion Problems: Finite volume formulations for one dimensional steady state diffusion, one dimensional unsteady diffusion: Explicit scheme, Crank-Nicolson scheme, fully implicit scheme

UNIT - V		**12 Hrs**

Finite Volume Method for Convection and Diffusion Problems: Finite volume formulation for steady one-dimensional convection and diffusion, the central differencing scheme, properties of discretisation schemes, upwind differencing scheme.

Course Outcomes(CO):

Upon successful completion of the course, the students will be able to

- Develop governing equations for fluid flow and heat transfer and classify the Partial differential equations.
- Adapt basic space and time finite difference discretisation techniques and
- Solve algebraic equations using direct and iterative techniques.
- Apply finite difference approach to solve one dimensional steady and unsteady Diffusion problems.

- Apply finite volume method for solving one dimensional steady and unsteady Diffusion problems.
- Solve one dimensional convection and diffusion problems using finite volume Method.

Textbooks:

1. John D. Anderson, J R "Computational fluid dynamics The basic with applications", Mc Graw Hill international, 2012.
2. H. Versteeg, W Malalasekra , "An Introduction to Computational Fluid
3. Dynamics The finite volume method", Pearson Publishers, 2nd Edition, 2018.

Reference Books

1. T. J. Chung - "Computational fluid dynamics", Cambridge university press, 2003
2. Suhas V. Patankar, "Numerical heat transfer and fluid flow" Butter-worth Publishers
3. T. K Sengupta, "Fundamentals of Computational Fluid Dynamics", University Press, 2013.

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Analysis and Synthesis of Mechanisms					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A03H03	**3: 1:0:0**	**4**	**CIE: 30 SEE:70**	**3Hours**	**HCC**

Course Objectives:

- To impart the concepts of force analysis of mechanisms.
- To familiarize with the concepts of synthesis of mechanisms.
- To impart hands on training on analysis and synthesis of mechanisms using software packages

Syllabus		**Total Hours:60**
UNIT - I	**Analysis of Complex mechanisms**	**12 Hrs**

Goodman indirect method and Hall Ault auxiliary point method

Dynamic Force Analysis: D Alembert principle , dynamic analysis of four bar mechanism and single slider crank mechanism – dynamically equivalent system – inertia of Connecting Rod – inertia force and torque in reciprocating Engine.

UNIT - II	**Path Curvature Theory**	**12Hrs**

Introduction, fixed and moving centrodes, inflection points and inflection circle, Euler Savary Equation, Bobilliers Construction, Collineation axis, Bobillier theorem, Hartmann construction

UNIT - III	**Kinematic Synthesis**	**12 Hrs**

Introduction, type, dimensional and number Synthesis ,synthesis for function generation, path and motion generation, Chebyschev Spacing of accuracy points

Motion Generation: Motion generation for two prescribed positions and three prescribed positions – path generation for three prescribed positions without and with prescribed timing – function generation for three prescribed positions, Poles and relative poles, relative poles of 4-bar mechanism, relative poles of slider crank mechanism.

UNIT - IV	**Coupler Curves**	**12 Hrs**

Equation of coupler curves, synthesis for path generation, graphical synthesis for path generation, Robert-Chebyshev theorem (cognate linkages), coupler curves from 5-bar mechanisms.

Analytical Synthesis Techniques: Four bar and slider crank function generator with three accuracy points , Freudenstein equation.

UNIT - V	**Manipulator Kinematics**	**12 Hrs**

Manipulator kinematics, position representation, forward and inverse transformations, homogeneous transformations, manipulator path control, robot arm dynamics, configuration of a robot controller, robot joint control design.

Course Outcomes(CO):

Upon successful completion of the course, the students will be able to

- Determine the displacement , velocity and accelerations of links of mechanism.
- Evaluate the forces and torque acting by performing force analysis.
- Apply path curvature characteristics in analysis of mechanisms.
- Apply synthesis techniques in design of mechanisms.
  Analyze and synthesize mechanisms using software packages

Textbooks:

1. Erdman and Sandor , "Advanced Mechanism Design ",Prentice Hall International, 2nd Edition
2. S.S. Rattan, "Theory of Machines",Tata Mc Graw Hill, 3rd Edition
3. JJ Craig, "Introduction to Robotic Mechanisms and Control" , Pearson, 3rd Edition.
4. Eric Constans and Karl B. Dyer, "Introduction to Mechanism Design With Computer Applications", CRC Press,1st Edition , 2019

Reference Books

5. Uicker, Pennock and Shigley, "Theory of machines and Mechanisms", Oxford Univ Press.
6. Amitabha Ghosh and Ashok Kumar Mallik, "Theory of Mechanism and machines", East West Press pvt Ltd, 2nd edition.
7. Robert L.Norton," Design of Machinery", Tata McGraw Hill, 3rd edition.

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Applications of Optimization Techniques					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A03H04	**3: 1:0:0**	**4**	**CIE: 30 SEE:70**	**3Hours**	**HCC**

Course Objectives:

- Explain principles of optimization and its need.
- Familiarization with theory of optimization methods and algorithms developed for solving various types of optimization problems.
- Understand the mathematical foundations for Genetic Algorithm, Operators.
- Know fundamental theory and concepts of neural networks, neuro – modelling, several neural network paradigms and its applications.
- Identify the application of optimization to design of machine elements.

Syllabus		**Total Hours:60**
UNIT - I	**Introduction**	**12 Hrs**

Classical Optimization Techniques: Single variable optimization with and without Constraints, Multi – Variable Optimization without constraints, Multi – Variable Optimization with Constraints – Method of Lagrange Multipliers, Kuhn-Tucker Conditions.
Numerical Methods for Optimization: Interval Halving Method, Fibonacci Method, Quadratic Interpolation Method, Newton Method, Quasi Newton Method, Secant Method.

UNIT - II	**Genetic Algorithm (GA)**	**12Hrs**

Differences and Similarities between Conventional and Evolutionary Algorithms, Working Principle, Reproduction, Crossover, Mutation, Termination Criteria, Different Reproduction and Crossover Operators, GA for Constrained Optimization, Draw Backs of GA.

UNIT - III	**Genetic Programming (GP)**	**12 Hrs**

Principles of Genetic Programming, Terminal Sets, Functional Sets, Differences between GA & GP, Random Population Generation, Solving Differential Equations using GP.

UNIT - IV	**Neural networks**	**12 Hrs**

Introduction to Neural networks: Knowledge base information processing, General View of Knowledge Based Algorithm, Neural Information Processing, Hybrid Intelligence and Artificial Neurons.
Characteristics of Artificial Neural Networks: Single Neural Networks, Multi – Layer Neural Networks, Training of ANN – Objective, Supervise Training, Unsupervised Training, Overview of training.

UNIT - V	**Applications of Optimization in Design and Manufacturing Systems**	**12 Hrs**

Some typical applications like Optimization of Path Synthesis of a Four – bar Mechanism, Minimization of Weight of a Cantilever Beam, Optimization of Springs and Gears, General Optimization model of a Machining Process, Optimization of Arc Welding Parameters and General Procedure in Optimizing Machining Operations Sequence.

Textbooks:

1. Singiresu S. Rao, Engineering Optimization, 3/e, New Age Publishers, 2010.
2. Bart Kosko, Neural Networks and Fuzzy System, 2/e, Prentice Hall of India, 2001.
3. Goldberg D.E., Genetic algorithms in Search, Optimization, and Machine learning, 4/e, Pearson, 2009.
4. Kalyanmoy Deb, Optimization for Engineering Design: Algorithms and Examples, 2/e, PHI Learning Pvt. Ltd., 2012

Reference Books:

1. Kalyanmoy Deb, Multi Objective Optimization using Evolutionary Algorithms, 1/e, John Wiley and Sons, 2001.
2. Jasbir S. Arora, Introduction to Optimum Design, 4/e, Academic Press, 2016.
3. Ravindran A., Engineering Optimization Methods and Applications, 2/e, John Wiley and Sons, 2006.
4. Fox R.L., Optimization Methods for Engineering Design, 1/e, Addison Wesley PublicationCo., 1971