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

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

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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

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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.