ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./Branch & Innovations

I B. Tech – I Semester

S.No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BS	19ABS9901	Algebra and Calculus	3	1	0	4	30	70	100
2	BS	19ABS9905	Engineering Chemistry	3	0	0	3	30	70	100
3	ES	19AES0501	Problem Solving and Programming	3	1	0	4	30	70	100
PRACTICAL										
4	LC	19ALC0301	Engineering Workshop Practice	0	0	3	1.5	30	70	100
5	ES	19AES0301	Engineering Graphics Lab	1	0	3	2.5	30	70	100
6	BS	19ABS9910	Engineering Chemistry Lab	0	0	3	1.5	30	70	100
7	ES	19AES0503	Problem Solving and Programming Lab	0	0	3	2	30	70	100
			TOTAL	**10**	**2**	**12**	**18.5**	**210**	**490**	**700**

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MECHANICAL ENGINEERING (ME)
I B. Tech – II Semester

S.No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	ES	19AES0202	Basics of Electrical & Electronics Engineering	3	0	0	3	30	70	100
2	BS	19ABS9906	Differential Equations and Vector Calculus	3	1	0	4	30	70	100
3	BS	19ABS9903	Engineering Physics	3	0	0	3	30	70	100
4	ES	19AES0502	Data Structures	3	0	0	3	30	70	100
5	HS	19AHS9901	Communicative English- I	2	0	0	2	30	70	100
PRACTICAL										
6	HS	19AHS9902	Communicative English – I Lab	0	0	2	1	30	70	100
7	LC	19ALC0302	Mechanical Engineering Workshop	0	0	2	1	30	70	100
8	ES	19AES0204	Basics of Electrical & Electronics Engineering Lab	0	0	3	1.5	30	70	100
9	BS	19ABS9908	Engineering Physics Lab	0	0	3	1.5	30	70	100
10	ES	19AES0504	Data Structures Lab	0	0	3	1.5	30	70	100
			TOTAL	**14**	**1**	**13**	**21.5**	**300**	**700**	**1000**

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II B. Tech – I Semester

S.No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BS	19ABS9913	Probability & Statistics, PDE and Complex Variables	3	0	0	3	30	70	100
2	HS	19AHS9903	Communicative English II	2	0	0	2	30	70	100
3	ES	19AES0302	Design Thinking & Product Innovation	2	0	0	2	30	70	100
4	PC	19APC0301	Engineering Mechanics	3	1	0	4	30	70	100
5	PC	19APC0306	Material Science and Engineering	3	0	0	3	30	70	100
6	PC	19APC0308	Thermodynamics	3	0	0	3	30	70	100
7	MC	19AMC9903	Environmental Studies	2	0	0	0	30	-	30
PRACTICAL										
8	HS	19AHS9904	Communicative English II Lab	0	0	2	1	30	70	100
9	ES	19AES0303	Design Thinking & Product Innovation Lab	0	0	2	1	30	70	100
10	PC	19APC0307	Material Science and Engineering Lab	0	0	2	1	30	70	100
11	LC	19ALC0303	Computer Aided Machine Drawing Lab	0	0	3	1.5	30	70	100
			TOTAL	**19**	**1**	**9**	**21.5**	**330**	**700**	**1030**

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II B. Tech – II Semester

S.No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BS	19ABS9915	Transform Techniques and Numerical Methods	3	0	0	3	30	70	100
2	PC	19APC0309	Kinematics of Machines	2	0	0	2	30	70	100
3	ES	19AES0505	Internet of Things (IoT)	2	0	0	2	30	70	100
4	PC	19APC0302	Mechanics of Materials	3	0	0	3	30	70	100
5	PC	19APC0312	Manufacturing Technology	3	0	0	3	30	70	100
6	PC	19APC0314	Fluid Mechanics & Hydraulic Machinery	3	0	0	3	30	70	100
7	MC	19AMC9901	Biology for Engineers	2	0	0	0	30	-	30
PRACTICAL										
8	PR	19APR0301	Socially Relevant Project (15 Hrs/Sem)	0	0	0	0.5	50	-	50
9	PC	19APC0315	Fluid Mechanics & Hydraulic Machinery Lab	0	0	2	1	30	70	100
10	ES	19AES0506	Internet of Things (IoT) Lab	0	0	2	1	30	70	100
11	PC	19APC0303	Mechanics of Materials Lab	0	0	3	1.5	30	70	100
12	PC	19APC0313	Manufacturing Technology Lab	0	0	3	1.5	30	70	100
			TOTAL	**16**	**0**	**10**	**21.5**	**380**	**700**	**1080**

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III B. Tech – I Semester

S.No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	19APC0325	Dynamics of Machines	3	0	0	3	30	70	100
2	PC	19APC0310	Thermal Engineering – I	3	0	0	3	30	70	100
3	PC	19APC0316	Design of Machine Members - 1	3	0	0	3	30	70	100
4	PC	19APC0324	Machine Tools	3	0	0	3	30	70	100
5	PE		**Professional Elective I**	3	0	0	3	30	70	100
		19APE0304	Nano Technology							
		19APE0305	Composite materials							
		19APE0306	Renewable Energy Technologies							
6	OE		**Open Elective I (Inter disciplinary)**	3	0	0	3	30	70	100
		19AHSMB01	Managerial Economics and Financial Analysis							
		19APE0501	Artificial Intelligence							
		19APE0416	Sensor Networks							
7	MC	19AMC9902	Constitution of India	2	0	0	0	30	-	30
PRACTICAL										
8	PR	19APR0302	Socially Relevant Projects (15 Hrs /Sem)	0	0	0	0.5	50	-	50
9	PC	19APC0311	Thermal Engineering Lab	0	0	2	1	30	70	100
10	PC	19APC0305	Machine Tools Lab	0	0	2	1	30	70	100
11	PC	19APC0315	Computer Aided Drafting Lab	0	0	2	1	30	70	100
			Total	**18**	**0**	**6**	**21.5**	**350**	**630**	**980**

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III B. Tech – II Semester

S. No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	19APC0316	Design of Machine Members – 2	3	1	0	4	30	70	100
2	PC	19APC0317	Heat Transfer	3	0	0	3	30	70	100
3	PC	19APC0319	Thermal Engineering – II	3	0	0	3	30	70	100
4	PE		**Professional Elective II**	3	0	0	3	30	70	100
		19APE0316	Management Science							
		19APE0317	Optimization Techniques							
		19APE0318	Introduction to CAD/CAM							
5	OE		**Open Elective II (Inter disciplinary)**	3	0	0	3	30	70	100
		19APC0513	Machine Learning							
		19APC0216	Neural Networks & Fuzzy Logics							
		19AOE0101	Structural Health Monitoring							
6	HE		**Humanities Elective I**	3	0	0	3	30	70	100
		19AHE9902	Principles of Effective Public Speaking							
		19AHE9904	Advanced Numerical Methods							
		19AHE9908	Electromagnetic Theory							
7	MC	19AMC9904	Professional Ethics and Human Values	2	0	0	0	30	-	30
PRACTICAL										
8	PR	19APR0303	Socially Relevant Projects (15 Hrs / Sem)	0	0	0	0.5	50	-	50
9	PC	19APC0318	Heat Transfer Lab	0	0	2	1	30	70	100
10	PC	19APC0320	Design & Simulation Lab	0	0	2	1	30	70	100
11	PR	19APR0	Industrial Training/ Internship/ Research Projects in National Laboratories/Academic Institutions	0	0	0	0	-	-	-
			Total	**18**	**0**	**6**	**21.5**	**320**	**560**	**880**

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IV B. Tech – I Semester

S. No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	19APC0321	Metrology and Measurements	2	0	0	2	30	70	100
2	PC	19APC0323	Operations Research	2	0	0	2	30	70	100
3	OE		**Open Elective IV (Inter disciplinary)**	3	0	0	3	30	70	100
		19AOE9901	Research Writing Skills							
		19AOE0501	E Commerce							
		19AOEMB02	Entrepreneurship							
4	PE		**Professional Elective III**	3	0	0	3	30	70	100
		19APE0307	Alternative Fuels and Emission Control in Automotive							
		19APE0308	Finite Element Analysis							
		19APE0309	Computational Fluid Dynamics							
5	PE		**Professional Elective IV**	3	0	0	3	30	70	100
		19APE0310	Power Transmission in Hybrid and Electric Vehicles							
		19APE0311	Material Characterization							
		19APE0312	Optimization Techniques through MATLAB							
6	HE		**Humanities Elective II**	3	0	0	3	30	70	100
		19AHE9903	Professional Communication							
		19AHE9906	Mathematical Modeling							
		19AHE9909	Quantum Mechanics							
PRACTICAL										
7	PC	19APC0322	Metrology and Measurements Lab	0	0	2	1	30	70	100
8	PR	19APR0304	Socially Relevant Project (15 hr/sem)	0	0	0	0	50	-	50
9	PR	19APR0305	Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions	0	0	4	2	50	-	50
			Total	**18**	**0**	**7**	**19**	**370**	**490**	**860**

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IV B. Tech – II Semester

S.No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	OE		**Open Elective V (MOOC)**	3	0	0	3	30	70	100
		19APC0515	Operating Systems							
		19AOEMB03	Intellectual Property Rights							
		19AOE9903	Environmental Waste Management							
2	PE		**Professional Elective V**	3	0	0	3	30	70	100
		19APE0313	Total Quality Management							
		19APE0314	Power Plant Engineering							
		19APE0315	Autotronics (Automobile Electronics)							
PRACTICAL										
3	PR	19APR0307	Project	0	0	14	9	60	140	200
4	PR	19APR0308	Technical Paper Presentation	0	0	0	0	50	-	50
			Total	**6**	**0**	**14**	**15**	**170**	**280**	**450**

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MECHANICAL ENGINEERING (ME)

Year : I **Semester** : I **Branch of Study : Common to all**

Subject Code	Subject Name	L	T	P	Credits
19ABS9901	Algebra & Calculus	3	1	0	4

Course Outcomes:

1. Develop the use of matrix algebra techniques that is needed by engineers for practical applications
2. Utilize mean value theorems to real life problems
3. Familiarize with functions of several variables which is useful in optimization
4. Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems
5. Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

UNIT I

Matrix Operations and Solving Systems of Linear Equations: Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

UNIT II

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof);

UNIT III

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

UNIT IV

Double Integrals: Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.

UNIT V

Multiple Integrals and Special Functions: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, Beta and Gamma functions and their properties, relation between beta and gamma functions.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

References:

1. Dr. T. K. V Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N Prasad, Mathematics-1, S.Chand publications.

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2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Engineering knowledge	1.1	1.1.1
CO 2	PO1: Engineering knowledge	1.1	1.1.1
CO 3	PO1: Engineering knowledge	1.1	1.1.1
CO 4	PO2 : Problem analysis	2.1	2.1.3
CO 5	PO2 : Problem analysis	2.1	2.1.3

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Year: I **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19ABS9905	Engineering Chemistry	3	0	0	3

Course Outcomes:

1. Differentiate between hard water and soft water. Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially
2. Understand the electrochemical sources of energy
3. Demonstrate the corrosion prevention methods and factors affecting corrosion
4. Explain the preparation, properties, and applications of thermoplastics & thermo settings, elastomers & conducting polymers.
5. Explain calorific values, octane number, refining of petroleum and cracking of oils
6. Explain the manufacturing of portland cement and concrete formation
7. Summarize the application of SEM, TEM and X-ray diffraction in surface characterization
8. Explain the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures

UNIT I

Water Technology: Introduction –Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles - scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

UNIT II

Electrochemistry and applications: Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells. Secondary cells – lead acid, nickel-metal hydride and lithium ion batteries- working of the batteries including cell reactions.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, environmental factors (pH, temperature, DO) affecting corrosion rate, Pourbaix diagrams for iron and aluminium, protection – corrosion inhibitors with specific examples, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT III

Polymers and Fuel Chemistry: Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Thermoplastics and Thermo-sets, Elastomers – applications with specific examples.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, refining of petroleum, liquid fuels, fuels for IC engines, knocking and anti-knock

agents, Octane and Cetane values, cracking of oils; alternative fuels- propane, methanol and ethanol, bio fuels.

UNIT IV

Cement and Concrete Chemistry: Introduction to building materials – Portland cement, constituents, manufacturing process-raw materials for manufacturing process, reactions below 1300 ^{o}C and reactions between 1300 and 1450 ^{o}C, reactions during cooling, grinding or storage, chemical equations, phases of cement clinker (alite, belite, aluminate and ferrite), reactivity of clinker phases, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ration (AR), chemistry of setting and hardening of cement (hydration, hydrolysis, equations), scheme of concrete formation, admixtures for concrete improvement – retarders, accelerators, air-entraining agents, grinding agents, super plasticizers, dispersants, etc.

UNIT V

Surface Chemistry and Applications: Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, characterization of surface by physicochemical methods (SEM, TEM, X-ray diffraction), solid-gas interface, solid-liquid interface, adsorption isotherm, BET equation (no derivation), calculation of specific surface area of solids, numerical problems, functionalization of surface of nanomaterials– applications of colloids and nanomaterials – catalysis, medicine, sensors, etc.

Text books:

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

Reference books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1:Engineering knowledge	1.2	1.2.1
CO 2	PO1:Engineering knowledge	1.4	1.4.1
CO 3	PO1:Engineering knowledge	1.2	1.2.1
CO 4	PO1:Engineering knowledge	1.2	1.2.1
CO 5	PO2: Problem Analysis	2.4	2.4.4
CO 6	PO1:Engineering knowledge	1.4	1.4.1
CO 7	PO2: Problem Analysis	2.4	2.4.4
CO 8	PO2: Problem Analysis	2.4	2.4.4

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Year : I **Semester : I** **Branch of Study : Common to All**

Subject Code	Subject Name	L	T	P	Credits
19AES0501	Problem Solving and Programming	3	1	0	4

Course outcomes: Student should be able to

1. Create interactive visual programs using Scratch.
2. Develop flowcharts using raptor to solve the given problems.
3. Develop Python programs for numerical and text based problems
4. Develop graphics and event based programming using Python
5. Develop Python programs using beautiful Pythonic idiomatic practices

UNIT I

Visual Programming through Scratch and App Inventor: Introduction to programming concepts with scratch, Scratch environment, sprites looks and motion, Angles and directions, repetition and variation, changing costumes, adding background, Input/Output, variables and operators. Working with sounds and sprite communication and creating stories, App Generation.

UNIT II

Flowchart design through Raptor: Flow chart symbols, Input/Output, Assignment, operators, conditional if, repetition, function and sub charts. Example problems(section 1) – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers

Example problems (section 2) - Fibonacci generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

UNIT III

Introduction to Python: Python – Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input / Output statements, Conditional If, while and for loops, User defined Functions, parameters to functions, recursive functions, Turtle Graphics.

UNIT IV

Data Structures and Idiomatic Programming in Python: Lists, Tuples, Dictionaries, Strings, Files and their libraries. Beautiful Idiomatic approach to solve programming problems.

UNIT V

Event driven Programming: Turtle Bar Chart, Event Driven programming. Key press events, Mouse events, timer events.

Text Books:

https://www.cse.msu.edu/~stockman/ITEC/Scratch/BGC2011Scratch-Rev1.pdf
https://nostarch.com/scratchplayground
http://fusecontent.education.vic.gov.au/9f79537a-66fc-4070-a5ce
e3aa315888a1/scratchreferenceguide14.pdf
https://raptor.martincarlisle.com/
http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf

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https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf
http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf

List of COs	PO no. and keyword	Competency	Performance Indicator
CO1	PO3: Design/Development of Solutions	3.1	3.1.4
CO2	PO3: Design/Development of Solutions	3.1	3.1.4
CO3	PO2: Problem analysis	2.2	2.2.2
CO4	PO2: Problem analysis PO3: Design/Development of Solutions	2.2 3.1	2.2.2 3.1.4
CO5	PO3: Design/Development of Solutions	3.1	3.1.4

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Year : I **Semester : I** **Branch of Study : Common to All**

Subject Code	Subject Name	L	T	P	Credits
19ALC0301	Engineering Workshop Practice	0	0	3	1.5

Course Outcomes:

CO: 1 Apply wood working skills in real world applications.
CO: 2 Build different parts with metal sheets in real world applications.
CO: 3 Apply fitting operations in various applications.
CO: 4 Apply different types of basic electric circuit connections.
CO: 5 Demonstrate soldering and brazing.

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 tyre 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

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 3: Design/Development of Solutions	3.2	3.2.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 3: Design/Development of Solutions	3.2	3.2.2
CO: 5	PO 2: Problem analysis	2.3	2.3.2

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Year: I **Semester : I** **Branch of Study : Common to All**

Subject Code	Subject Name	L	T	P	Credits
19AES0301	Engineering Graphics Lab	1	0	3	2.5

Course Outcomes:

CO: 1 Draw various curves applied in engineering.
CO: 2 Show projections of solids and sections graphically.
CO: 3 Draw the development of surfaces of solids.
CO: 4 Use computers as a drafting tool.
CO: 5 Draw isometric and orthographic drawings using CAD packages.

Manual Drawing

UNIT I

Introduction to Engineering graphics: Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,
b) Cycloid, epicycloids and hypocycloid
c) Involutes

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line.

UNIT II

Projections of Planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.
Projections of Solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

UNIT III

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

Computer Aided Drafting:

UNIT IV

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.

UNIT V

Orthographic Projections: Systems of projections, conventions and application to orthographic projections.
Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, figures, simple and compound solids.

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Text Books and Reference Books:

1. K. L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers
2. N. D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers
3. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill
4. Shah and Rana, Engineering Drawing, 2/e, Pearson Education
5. Basant Agrawal & C. M. Agrawal, Engineering Drawing, Tata McGraw-Hill

Additional Sources

YouTube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 3: Design/Development of Solutions	3.2	3.2.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 3: Design/Development of Solutions	3.2	3.2.2
CO: 5	PO 5: Problem analysis	5.1	5.1.1

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Year: I **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19ABS9910	Engineering Chemistry Lab	0	0	3	1.5

Course Outcomes:

1. Determine the cell constant and conductance of solutions
2. Prepare advanced polymer materials
3. Determine the physical properties like surface tension, adsorption and viscosity
4. Estimate the Iron and Calcium in cement
5. Calculate the hardness of water

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
3. Determination of cell constant and conductance of solutions
4. Potentiometry - determination of redox potentials and emfs
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of a polymer
7. Determination of viscosity of polymer solution using survismeter
8. Determination of percentage of Iron in Cement sample by colorimetry
9. Estimation of Calcium in port land Cement
10. Preparation of nanomaterials
11. Adsorption of acetic acid by charcoal
12. Determination of percentage Moisture content in a coal sample

COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 4: Conduct Investigations of complex problems	4.3	4.3.3
CO 2	PO 4: Conduct Investigations of complex problems	4.3	4.3.1
CO 3	PO 4: Conduct Investigations of complex problems	4.3	4.3.1
CO 4	PO 4: Conduct Investigations of complex problems	4.3	4.3.2
CO 5	PO 4: Conduct Investigations of complex problems	4.3	4.3.2

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Year: I **Semester : I** **Branch of Study : Common to all**

Subject Code	Subject Name	L	T	P	Credits
19AES0503	Problem Solving and Programming Lab	0	0	3	2

Course outcomes: Student should be able to

1. Create interactive visual programs using Scratch.
2. Develop flowcharts using raptor to solve the given problems.
3. Develop Python programs for numerical and text based problems
4. Develop graphics and event based programming using Python
5. Develop Python programs using beautiful Pythonic idiomatic practices

1. Design a script in Scratch to make a sprite to draw geometrical shapes such as Circle, Triangle, Square, Pentagon.
2. Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.
3. Design a Memory Game in Scratch which allows the user to identify positions of similar objects in a 3 x 3 matrix.
4. Construct flowcharts to
   a. calculate the maximum, minimum and average of N numbers
   b. develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
5. Construct flowcharts with separate procedures to
   a. calculate simple and compound interest for various parameters specified by the user
   b. calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user
6. Construct flowcharts with procedures to
   a. generate first N numbers in the Fibonacci series
   b. generate N Prime numbers
7. Design a flowchart to perform Linear search on list of N unsorted numbers(Iterative and recursive)
8. Design a flowchart to perform Binary search on list of N sorted numbers(Iterative and recursive)
9. Design a flowchart to determine the number of characters and lines in a text file specified by the user
10. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
11. Design a Python script to determine if a given string is a Palindrome using recursion
12. Design a Python script to sort numbers specified in a text file using lists.
13. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
14. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
15. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
16. Design a Python Script to find the value of (Sine, Cosine, Log, PI, *e*) of a given number using infinite series of the function.
17. Design a Python Script to convert a given number to words

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18. Design a Python Script to convert a given number to roman number.
19. Design a Python Script to generate the frequency count of words in a text file.
20. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
21. Design a Python Script to implement Gaussian Elimination method.
22. Design a Python script to generate statistical reports(Minimum, Maximum, Count, Average, Sum etc) on public datasets.
23. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorising them into distinction, first class, second class, third class and failed.

Text Book:
http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf

List of COs	PO no. and keyword	Competency	Performance Indicator
CO1	PO3: Design/Development of Solutions	3.1	3.1.4
CO2	PO3: Design/Development of Solutions	3.1	3.1.4
CO3	PO2: Problem analysis	2.2	2.2.2
CO4	PO2: Problem analysis PO3: Design/Development of Solutions	2.2 3.1	2.2.2 3.1.4
CO5	PO3: Design/Development of Solutions	3.1	3.1.4

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Year: I Semester : II Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19AES0202	Basics of Electrical & Electronics Engineering	3	0	0	3

Course Outcomes: Students should be able to
CO 1: Apply concepts of KVL/KCL in solving DC circuits
CO 2: Illustrate working principles of induction motor - DC Motor
CO 3: Identify type of electrical machine based on their operation
CO 4: Describe operation and characteristics of diodes and transistors.
CO 5: Make use of diodes and transistors in simple, typical circuit applications.
CO 6: Understand operation of basic op-amp circuits.

PART-A (Electrical Engineering)

UNIT I

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.

UNIT II

DC & AC 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 Motor – Principle and operation of Single Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor [Elementary treatment only]

UNIT III

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.

Text Books:

1. D. P. Kothari and I. J. Nagrath - “Basic Electrical Engineering” - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, “Principles of Power System” – S.Chand – 2018.

References:

1. L. S. Bobrow - “Fundamentals of Electrical Engineering” - Oxford University Press - 2011.
2. E. Hughes - “Electrical and Electronics Technology” - Pearson - 2010.
3. C.L. Wadhwa – “Generation Distribution and Utilization of Electrical Energy”, 3rd Edition, New Age International Publications.

PART-B (Electronics Engineering)

UNIT I

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Analog Electronics: Overview of Semiconductors, PN junction diode, Zener diode, Applications of diode as switch and rectifier, Zener diode as regulator, special purpose diodes: schottky diode, tunnel diode, varactor diode, photodiode, phototransistor and LED.
BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications
Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.

UNIT II
Digital Electronics: Introduction, Switching and Logic Levels, Digital Waveform, characteristics of digital ICs, logic gates, number systems, combinational circuits - adders, multiplexers, decoders; introduction to sequential circuits, flip flops, shift register, binary counter.

UNIT III
Communication Systems: Introduction, Elements of Communication Systems, EM spectrum, basics of electronic communication, Amplitude and Frequency modulation, Pulse modulation, Communication receivers, Examples of communication systems: Microwave & Satellite, Fibre optic, Television, mobile communication (block diagram approach).

Text Books:
1. D.P. Kothari, I.J.Nagrath, Basic Electronics, 2nd edition, McGraw Hill Education(India)Private Limited
2. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 2nd edition, Pearson India Private Limited.

References:
1. R. Muthu subramanian, S. Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw-Hill Education, Reprint 2012.
2. David Bell, Electronic Devices and Circuits: Oxford University Press, 5th edition. 2008.

Note: This table also should be in portrait only

List of COs	PO no. and keyword	Competency	Performance Indicator
CO1	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO2	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO3	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO4	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1
CO5	PO1	1.3	1.3.1
	PO2	2.3	2.3.1

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	PO3	3.3	3.3.1
CO6	PO1	1.3	1.3.1
	PO2	2.3	2.3.1
	PO3	3.3	3.3.1

Year: I **Semester : II** **Branch of Study : CE & ME**

Subject Code	Subject Name	L	T	P	Credits
19ABS9906	Differential Equations and Multivariable Calculus	3	1	0	4

Course Outcomes:
1. Apply the mathematical concepts of ordinary differential equations of higher order.
2. Solve the differential equations related to various engineering fields.
3. Identify solution methods for partial differential equations that model physical processes.
4. Interpret the physical meaning of different operators such as gradient, curl and divergence.
5. Estimate the work done against a field, circulation and flux using vector calculus.

UNIT I
Linear Differential Equations of Higher Order: Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

UNIT II
Equations Reducible to Linear Differential Equations and Applications: Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems

UNIT III
Partial Differential Equations – First order:
First order partial differential equations, solutions of first order linear and non-linear PDEs. Solutions to homogenous and non-homogenous higher order linear partial differential equations.

UNIT IV
Multivariable Calculus (Vector differentiation): 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
Multivariable Calculus (Vector integration): 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).

Text Books:
1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.

References:

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1. Dr. T. K. V. Iyengar, Engineering Mathematics-I, S. Chand publishers
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi publication, 2008

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Engineering Knowledge	1.1	1.1.1
CO 2	PO2: Problem Analysis	2.1	2.1.3
CO 3	PO1: Engineering Knowledge	1.1	1.1.1
CO 4	PO1: Engineering Knowledge	1.1	1.1.1
CO 5	PO2: Problem Analysis	2.1	2.1.3

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Year : I Semester : II Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19ABS9903	Engineering Physics	3	0	0	3

Course Outcomes:
1. Explain physics applied to solve engineering problems
2. Apply the principles of acoustics in designing of buildings
3. Explains the applications of ultrasonic in various engineering fields
4. Apply electromagnetic wave propagation in different Optical Fibers and the concepts of lasers in various applications.
5. Explains the concepts of dielectric and magnetic materials and Identify the sensors for various engineering applications

UNIT I
Mechanics: Basic laws of vectors and scalars – rotational frames-conservative forces- F=-gradV, torque and angular momentum-Newton's laws in inertial and linear accelerating non-inertial frames of reference-rotating frame of reference with constant angular velocity-qualitative explanation of Foucault's pendulum-rigid body-angular velocity vector-center of mass-gravitation and Keplar's Law (Qualitative).

UNIT II
Crystallography And Ultrasonics: Crystallography – Introduction – Space Lattice – Unit Cell – Lattice Parameters – Bravais Lattice – Crystal Systems – Packing Fractions of SC, BCC and FCC. X-Ray Diffraction – Braggs Law – Powder Method.
Ultrasonics: Introduction, Properties and Production by magnetostriction & piezoelectric methods - acoustic grating-Non Destructive Testing–pulse echo system through transmission and reflection modes-A,B and C–scan displays, Medical applications.

UNIT III
Dielectric and Magnetic Materials: Dielectric polarizability, Susceptibility and Dielectric constant-Types of polarizations: Electronic , Ionic, Orientation Polarizations (Qualitative)-Frequency dependence of polarization-Lorentz (internal) field-Claussius-Mosotti equation-Applications of Dielectrics.
Introduction-Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of Magnetic materials-Domain Concepts of ferromagnetism – Hysteresis – soft and hard magnetic materials-Magnetic device applications.

UNIT IV
Lasers and Fiber Optics: Introduction-Characteristics of Laser – Spontaneous and Stimulated emission of radiation-Einstein's coefficients-Population inversion-Pumping Mechanisms -He- Ne laser, Nd-YAG laser-Semiconductor laser-Applications of laser.
Introduction to Optical Fibers – Total Internal Reflection-Construction of optical fibers, Critical angle of propagation – Acceptance angle – Numerical Aperture-Classification off ibers based on Refractive index profile & modes – Propagation of electromagnetic wave through optical fiber-importance of V number-Block Diagram of Fiber optic Communication system-Medical Applications.

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UNIT V

Nanomaterials: Introduction – Significance of nanoscale and types of nanomaterials – Physical properties, optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials by Top down and bottom up approaches, ball mill, chemical vapour depositon and sol-gel – Applications of nanomaterials.

Textbooks:

1. M. N. Avadhanulu, P.G. Kshirsagar&TVS Arun Murthy". A Text book of Engineering Physics"-S.Chand Publications,11th Edition2019
2. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education, 2018

References:

1. K.Thyagarajan "Engineering Physics",-Mc Graw Hill Publishing Company Ltd,2016
2. MKVarma "Introduction to Mechanics"-Universities Press-2015.
3. D.K. Bhattacharya and A.Bhaskaran,"Engineering Physics"-Oxford Publications-2015
4. IanRSinclair,Sensor andTransducers,3rd eds,2001,Elsevier(Newnes)

COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1 : Engineering knowledge	1.2	1.2.1
CO 2	PO1 : Engineering knowledge	1.2	1.2.1
CO 3	PO1 : Engineering knowledge	1.2	1.2.1
CO 4	PO1 : Engineering knowledge	1.2	1.2.1
CO 5	PO1 : Engineering knowledge	1.2	1.2.1

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Year: I **Semester : II** **Branch of Study : CE & ME**

Subject Code	Subject Name	L	T	P	Credits
19AES0502	Data Structures	3	0	0	3

Course Outcomes:
Students should be able to
1. Select Appropriate Data Structure for solving a real world problem (L4)
2. Select appropriate file organization technique depending on the processing to be done (L4)
3. Construct Indexes for Databases (L6)
4. Analyse the Algorithms (L4)
5. Develop Algorithm for Sorting large files of data (L3)

UNIT I
Introduction: Algorithm Specification, Performance analysis, Performance Measurement. Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions. Sorting: Motivation, Quick sort, How fast can we sort, Merge sort, Heap sort

UNIT II
Stack, Queue and Linked lists: Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

UNIT III
Trees: Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, Counting Binary Trees, Optimal Binary search Trees, AVL Trees. **B-Trees:** B Trees, B+ Trees.

UNIT IV
Graphs and Hashing: The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

UNIT V:
Files and Advanced sorting: File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization. Advanced sorting: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

Text Books:
1. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures in C”, 2nd Edition, Galgotia Book Source, Pvt. Ltd., 2004.
2. Alan L. Tharp, “File Organization and Processing”, Wiley and Sons, 1988.

Reference Books:
1. D. Samanta, “Classic Data Structures”, 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
2. Peter Bras, “Advanced Data Structures”, Cambridge University Press, 2016.

3. Richard F.Gilberg, Behrouz A. Forouzan, "Data Structures A Pseudo code Approach with C", Second Edition, Cengage Learning 2005.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO1	PO1: Engineering Knowledge	1.4	1.4.1
CO2	PO4: Conduct investigations of complex problems	4.1	4.1.4
CO3	PO1: Engineering Knowledge	1.3	1.3.1
CO4	PO2: Problem analysis	2.1	2.1.2
CO5	PO2: Problem analysis	2.3	2.3.1

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Year: I **Semester : II** **Branch of Study : Common to All**

Subject Code	Subject Name	L	T	P	Credits
19AHS9901	Communicative English I	2	0	0	2

Course Outcomes:

1. Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English.
2. Formulate sentences using proper grammatical structures and correct word forms.
3. Speak clearly on a specific topic using suitable discourse markers in informal discussions.
4. Write summaries based on global comprehension of reading / listening texts.
5. Produce a coherent paragraph interpreting a figure/graph/chart/table.
6. Take notes while listening to a talk/lecture to answer questions

UNIT I

Technology With a Human Face – Schumacher:

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 one self 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: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

UNIT II

I have three visions for India: Presidential Speech by Abdul Kalam:

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: Cohesive devices -linkers, sign posts and transition signals; use of articles and zero article; prepositions.

UNIT III

The Gold Frame by RK. Laxman:

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.

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Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.
Grammar and Vocabulary: Verbs -tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

UNIT IV
To be, or not to be by William Shakesphere:
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: Studying the use of graphic elements in texts to convey information, reveal trends / patterns / relationships, communicate processes or display complicated data.
Writing: Information transfer; describe, compare, contrast, identify significance / trends based on information provided in figures / charts / graphs / tables.
Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms.

UNIT V
The Accompanist by Anitha Desai:
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: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO6: Engineer and Society	6.1	6.1.1
CO 2	PO10: Communication	10.1	10.1.1
CO 3	PO9: Individual and Teamwork	9.2	9.2.1
CO 4	PO10: Communication	10.1	10.1.1
CO 5	PO10: Communication	10.3	10.3.1
CO 6	PO10: Communication	10.2	10.2.1

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Year: I **Semester : II** **Branch of Study : Common to All**

Subject Code	Subject Name	L	T	P	Credits
19AHS9902	Communicative English Lab	0	0	2	1

Course Outcomes:

CO1: Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
CO2: Apply communication skills through various language learning activities.
CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
CO4: Evaluate and exhibit acceptable etiquette essential in social and professional settings.
CO5: Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

UNIT I

1. Phonetics for listening comprehension of various accents
2. Reading comprehension
3. Describing objects/places/persons

UNIT II

1. JAM
2. Small talks on general topics
3. Debates

UNIT III

1. Situational dialogues – Greeting and Introduction
2. Summarizing and Note making
3. Vocabulary Building

UNIT IV

1. Asking for Information and Giving Directions
2. Information Transfer
3. Non-verbal Communication – Dumb Charade

UNIT V

1. Oral Presentations
2. Précis Writing and Paraphrasing
3. Reading Comprehension and spotting errors

List of COs	PO No. and keyword	Competency	Performance Indicator
CO 1	PO10: Communication	10.2	10.1.1
CO 2	PO10: Communication	10.3	10.3.1
CO 3	PO10: Communication	10.2	10.2.1
CO 4	PO 9: Individual & Team Work	9.2	9.2.1
CO 5	PO10: Communication	10.2	10.2.1

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Year: I **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19ALC0302	Mechanical Engineering Workshop	0	0	2	1

Course Outcomes:

CO: 1 Make moulds for sand casting
CO: 2 Develop different weld joints
CO: 3 Assemble or disassemble of machine components
CO: 4 Make plastic components
CO: 5 Use power tools and find applications of hydraulic and pneumatic circuits

I Foundry Practice: (2 Sessions)

1. (a) Determination of average grain size for sand sample using sieve shaker
   (b) Preparation of a green sand mould using single piece pattern
2. Preparation of a green sand mould using split piece pattern with core and demonstration of casting.

II Welding Practice: (2 Sessions)

i) Lap joint, butt joint and T joint using arc welding.
ii) Lap joint using resistance spot welding
iii) Lap and butt joints using gas welding

III Assembling/Disassembling Practice: (3 Sessions)

i) Bicycle
ii) Clutch and carburetor
iii) Two wheeler engine

IV Manufacture of a Plastic Component (2 Sessions)

i) Use of injection moulding machine
ii) Joining of plastic components

V Design and manufacture any two domestic utility products with any material (2 Sessions)

VI Use of Power Tools (2 Sessions)

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.4	1.4.1
CO: 2	PO 3: Design/Development of Solutions	3.1	3.1.1
CO: 3	PO 5: Modern tool usage	5.3	5.3.1
CO: 4	PO 3: Design/Development of Solutions	3.1	3.1.1
CO: 5	PO 5: Modern tool usage	5.3	5.3.1

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Year: I **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19ABS9908	**Engineering Physics Lab**	0	0	3	1.5

Course Outcomes:

1. Operate various optical instruments and Estimate wavelength of laser and particles size using laser.
2. Estimate the susceptibility and related magnetic parameters of magnetic materials and plot the intensity of the magnetic field of circular coil carrying current with distance.
3. Evaluate the acceptance angle of an optical fiber and numerical aperture anddetermine magnetic susceptibility of the material and its losses by B-H curve.
4. Identify the type of semiconductor i.e., n-type or p-type using Hall effect.
5. Apply the concepts of sensors for various applications.

List of Experiments

1. Determination of wavelength of LASER light using diffraction grating.
2. Determination of particle size using LASER.
3. Determination of spring constant of springs using Coupled Oscillator.
4. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
5. Determination of Dielectric constant of dielectric material using charging and discharging of capacitor.
6. Magnetic field along the axis of a circular coil carrying current.
7. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
8. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
9. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
10. Measurement of magnetic susceptibility by Gouy's method
11. Determination of ultrasonic velocity in liquid (Acoustic grating)
12. Determination of pressure variation using Strain Guage sensor
13. Determination of temperature change using Strain Guage sensor.
14. Determination of pressure variations using optical fiber sensors.
15. Determination of temperature changes using optical fiber sensors.

References:

1. S. Balasubramanian, M.N.Srinivasan, "A Text book of Practical Physics"-S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php-VirtualLabs, Amrita University.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 4: Conduct Investigations of complex problems	4.3	4.3.3
CO 2	PO 4: Conduct Investigations of complex problems	4.3	4.3.1
CO 3	PO 4: Conduct Investigations of complex problems	4.3	4.3.1
CO 4	PO 4: Conduct Investigations of complex problems	4.3	4.3.2
CO 5	PO 4: Conduct Investigations of complex problems	4.3	4.3.2

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Year: I **Semester : II** **Branch of Study : Common to All**

Subject Code	Subject Name	L	T	P	Credits
19AES0504	Data Structures Lab	0	0	3	1.5

Course outcomes:

1. Select the data structure appropriate for solving the problem
2. Implement searching and sorting algorithms
3. Design new data types
4. Illustrate the working of stack and queue
5. Organize the data in the form of files

Laboratory Experiments

1. String operations using array of pointers
2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms.
3. Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time.
4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List
5. Stack implementation using arrays
6. Stack implementation using linked lists
7. Queue implementation using arrays. Implement different forms of queue. While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank.
8. Queue implementation using linked lists
9. Creation of binary search tree, performing operations insertion, deletion, and traversal.
10. Breadth first search
11. Depth first search
12. Travelling sales man problem
13. File operations
14. Indexing of a file
15. Reversing the links (not just displaying) of a linked list.
16. Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using ‘Ladies first’ principle. You may create new linked lists if necessary.
17. An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form.
18. A table can be defined as a collection of rows and columns. Each row and column may have a label. Different values are stored in the cells of the table. The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operations are to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table. User may like to remove row/column. Create table data type and support different operations on it.

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List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Engineering Knowledge	1.4	1.4.1
CO2	PO 2: Problem analysis	2.2	2.2.4
CO3	PO1: Engineering Knowledge	1.3	1.3.1
CO4	PO1: Engineering Knowledge	1.4	1.4.1
CO5	PO1: Engineering Knowledge	1.4	1.4.1

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Year: II **Semester: I** **Branch of Study: ME**

Subject Code	Subject Name	L	T	P	Credits
19ABS9913	Probability & Statistics, PDE, Complex Variables	3	0	0	3

Course Outcomes:

CO: 1 Apply discrete and continuous probability distributions
CO: 2 Design the components of a classical hypothesis test
CO: 3 Infer the statistical inferential methods based on small and large sampling tests
CO: 4 Find the general solution of the PDEs bearing applications
CO: 5 Differentiation and integration of complex functions used in engineering problems
To equip the students to solve application problems in their disciplines

UNIT I

Probability: probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous)**,** probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties.

UNIT II

Testing of Hypothesis: Formulation of null hypothesis, critical regions, level of significance. Large sample tests: test for single proportion, difference of proportions, test for single mean and difference of means.

Unit III: Small Sample Tests

Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit.

Unit IV: Applications of Partial Differential Equations

Method of separation of variables, solution of 1D-wave, 1D-heat and 2D-Laplace's equation in Cartesian coordinates.

Unit V: Complex Variables

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Complex integration, Cauchy theorem (without proof), Cauchy integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series, residues, Cauchy residue theorem (without proof)
importance of ergonomics in product development, environmental considerations in design, safety considerations in design.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

References:

1. S.Chand ,Engineering Mathematics-II,III &IV by Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad

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2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO2	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO3	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO4	PO 2: First principles of mathematics.	2.1	2.1.3
CO5	PO 2: First principles of mathematics	2.4	2.4.1

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Year: II **Semester: I** **Branch of Study: ME**

Subject Code	Subject Name	L	T	P	Credits
19AHS9903	Communicative English II	2	0	0	2

Course Outcomes:

CO: 1	Prioritize information from reading texts after selecting relevant and useful points
CO: 2	Paraphrase short academic texts using suitable strategies and conventions
CO: 3	Make formal structured presentations on academic topics using PPT slides with relevant graphical elements
CO: 4	Participate in group discussions using appropriate conventions and language strategies
CO: 5	Prepare a CV with a cover letter to seek internship/ job
CO: 6	Collaborate with a partner to make presentations and Project Reports

UNIT I

Listening: Listening for presentation strategies and answering questions on the speaker, audience, and key points.
Speaking: Formal presentations using PPT slides without graphic elements.
Reading: Reading for presenting – strategies to select, compile and synthesize information for presentation; reading to recognize academic style.
Writing: Paraphrasing; using quotations in writing; using academic style - avoiding colloquial words and phrases.
Grammar and Vocabulary: Formal/academic words and phrases.

UNIT II

Listening: Following an argument/ logical flow of thought; answering questions on key concepts after listening to extended passages of spoken academic discourse.
Speaking: Formal presentations using PPT slides with graphic elements.
Reading: Understand formal and informal styles; recognize the difference between facts and opinions.
Writing: Formal letter writing and e-mail writing (enquiry, complaints, seeking permission, seeking internship); structure, conventions and etiquette.
Grammar and Vocabulary: Phrasal prepositions; phrasal verbs.

Unit III:

Listening: Identifying views and opinions expressed by different speakers while listening to discussions.
Speaking: Group discussion on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position.
Reading: Identifying claims, evidences, views, opinions and stance/ position.
Writing: Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidences.
Grammar and Vocabulary: Language for different functions such as stating a point, expressing opinion, agreeing/disagreeing, adding information to what someone has stated, and asking for clarification.

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Unit IV:
Listening: Understanding inferences; processing of information using specific context clues from the text.
Speaking: Group discussion; reaching consensus in group work (academic context).
Reading: Reading for inferential comprehension.
Writing: Applying for internship/ job - Writing one's CV/Resume and cover letter.
Grammar and Vocabulary: Active and passive voice – use of passive verbs in academic writing.

Unit V:
Listening: Understanding inferences - processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge.
Speaking: Formal team presentations on academic/ general topics using PPT slides.
Reading for Writing: Structure and contents of a Project Report; identifying sections in project reports; understanding the purpose of each section; significance of references.
Grammar and Vocabulary: Reinforcing learning; editing short texts; correcting common errors in grammar and usage.

***Course Materials would be compiled and provided to learners and teachers**
ReferenceBooks
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.Sample Web Resources Grammar/Listening/Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/

Grammar/Vocabulary
English Language Learning Online, http://www.bbc.co.uk/learningenglish/, http://www.better-english.com/, http://www.nonstopenglish.com/, https://www.vocabulary.com/, BBC Vocabulary Games, Free Rice Vocabulary Game

Reading
https://www.usingenglish.com/comprehension/, https://www.englishclub.com/reading/short-stories.htm, https://www.english-online.at/

Listening
https://learningenglish.voanews.com/z/3613, http://www.englishmedialab.com/listening.html
Speaking
https://www.talkenglish.com/, BBC Learning English – Pronunciation tips, Merriam-Webster – Perfect pronunciation Exercises
All Skills
https://www.englishclub.com/, http://www.world-english.org/, http://learnenglish.britishcouncil.org/, Online Dictionaries, Cambridge dictionary online, MacMillan dictionary, Oxford learner's dictionaries

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References:

1.www.pointblank7.in> News & Politics> Features dt. 15.05.2019
2. Learning English a Communication Approach by Orient Longman Pvt Ltd. Hyderabad , 2005

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.1	10.1.1 10.1.2
CO2	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.3	10.3.1 10.3.2
CO3	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.2	10.2.2
CO4	PO9-Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9.2	9.2.1 9.2.2 9.2.3
CO5	PO10-Able to comprehend and write effective reports and design documentation.	10.3	10.3.1 10.3.2

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Year: II **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AES0302	Design Thinking and Product Innovation	2	0	0	2

Course Outcomes:

CO: 1 Summarize the importance of basic sciences in product development
CO: 2 Explain the historical developments in mechanical, electrical, communications and computational engineering
CO: 3 Apply systematic approach to innovative designs
CO: 4 Identify new materials and manufacturing methods in design
CO: 5 Explain and study of Product Development

UNIT I

Engineering Design: What is designing?, Ther process of design by evolution, the morphology of design, identification and analysis of need, true need, specifications, standards of performance, use of checklists, morphological analysis, brainstorming, measure of physical realizability, economic and financial feasibility, designing for shipping, handling and installation, design for maintainance, detailed design.

UNIT II

Science to Engineering: Job of engineers, engineering units and measurement, elements of engineering analysis, forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission.
Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, electrical induction in engineering products.

UNIT III

Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.

UNIT IV

Reverse engineering in product development: Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, safety considerations in design.

UNIT V

Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

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Reference Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4/e, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2/e, Laurence King Publishing Ltd., 2010
3. An AVA Book, "Design Thinking", AVA Publishing, 2010.
4. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3/e, Springer, 2007.
5. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006
6. Fundamentals of Design and Manufacturing by G. K. Lal, Vijay Gupta, and N. Venkata Reddy, Narosa Publishing House.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO3: Design/development of solutions	3.1	3.1.1
CO: 2	PO 1: Engineering knowledge	1.3	1.3.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO3: Design/development of solutions	3.1	3.1.1
CO: 5	PO 1: Engineering knowledge	1.3	1.3.1

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Year: II **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0301	Engineering Mechanics	3	1	0	4

Course Outcomes:

CO: 1 Resolve forces and moments in mechanical systems.
CO: 2 Identify the frictional forces and its influence on equilibrium.
CO: 3 Find the centre of gravity and moment of inertia for various geometric shapes
CO: 4 Demonstrations of equilibrium of ideal systems and estimation of the work done by the force and the couple
CO: 5 Determine the displacement, velocity and acceleration relations in dynamic systems

UNIT I

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.

UNIT II

Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction, screw friction. Free body diagrams involving frictional forces.
Analysis of Structures: Introduction to plane trusses, analysis of plane trusses by method of joints.

UNIT III

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-guldinus.
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

UNIT IV

Virtual Work: Equilibrium of ideal systems, work done by a force, work done by a couple, principle of virtual work.
Kinematics: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion and 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.

UNIT V

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.

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Text Books:

1. N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.
2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.
3. S S Bhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

Reference Books:

1. Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2. Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynamics, 4/e, Pearson, 2009.
3. K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.
4. Kalathur Kumar, VVN Bhaskar. Engineering Mechanics, Sri Krishna publications. (2015)

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1: Engineering knowledge	1.3	1.3.1
CO: 2	PO2: Modern tool usage	2.1	2.1.3
CO: 3	PO4: Conduct investigations of complex problems	4.1	4.1.2
CO: 4	PO2: Problem analysis	2.1	2.1.2
CO: 5	PO7: Environment and sustainability:	7.1	7.1.2

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Year: II **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0306	Material Science and Engineering	3	0	0	3

Course Outcomes:

CO: 1 Explain the principles of binary phases
CO: 2 Apply heat treatment to different applications
CO: 3 Select steels and cast irons for a given application
CO: 4 Utilize nonferrous metals and alloys in engineering
CO: 5 Choose composites for various applications. Assess the properties of nano-scale materials and their applications

UNIT I

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; Iron-Iron-carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT II

Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, Continuous cooling curves and interpretation of final microstructures and properties-austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening

UNIT III

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI & BIS classification of steels. Classification, Micro structure, properties and applications of alloy steels and tool steels.

Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT IV

Non-ferrous Metals and Alloys: Micro structure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al-Cu phase diagram, precipitation hardening. Micro structure, properties and applications of titanium and its alloys

UNIT V

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

Text Books:

1. Sydney H. Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
2. George E. Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

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Reference Books:

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.
3. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
4. L. H.Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 5: Modern tool usage	5.2	5.2.2
CO: 3	PO 5: Modern tool usage	5.2	5.1.2
CO: 4	PO 5: Modern tool usage	5.2	5.2.2
CO: 5	PO 1: Engineering knowledge	1.6	1.3.1
	PO 7: Environment and sustainability	7.4	7.2.1

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Year: II **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0308	Thermodynamics	3	0	0	3

Course Outcomes:

CO: 1 Explain the importance of thermodynamic properties related to conversion of heat energy into work.

CO: 2 Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.

CO: 3 To understand concept of Entropy and Availability of system

CO: 4 Utilize steam properties to design steam based components.

CO: 5 Compare thermodynamic relations and air standard cycles.

UNIT I

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.

Properties of Steam and use of Steam Tables: 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

UNIT II

First law of Thermodynamics: 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.

Second Law of Thermodynamics: 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: Clausius inequality - Concept of Entropy- entropy equation for different processes and systems

Availability and Irreversibility: Definition of exergy and energy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

UNIT IV

Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart. Gibbs-Dalton law, volumetric analysis of gas mixture, apparent molecular weight and gas constant, specific heat of a gas mixture, adiabatic mixing of perfect gases, gas and vapour mixtures.

UNIT V

Thermodynamic Relations: Maxwell relations, TdS equations, difference in heat capacities, ratio of heat capacities, Energy equation, Joule Thompson coefficient, Clausius-Clapeyron equation. Reactive mixture of gases

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Text Books:

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. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009
4. R. K. Rajput, S. Chand & Co., Thermal Engineering, 6/e, Laxmi publications, 2010.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 2: Problem analysis	2.5	2.1.3
CO: 2	PO 1: Engineering knowledge PO 2: Problem analysis	2.2	2.2.3
CO: 3	PO 1: Engineering knowledge PO 2: Problem analysis	2.1	2.1.3
CO: 4	PO 1: Engineering knowledge PO 2: Problem analysis PO 3: Design/development of solutions	2.2	2.2.3
CO: 5	PO 1: Engineering knowledge PO 2: Problem analysis	2.4	2.4.3

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Year: II **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AMC9903	Environmental Studies	3	0	0	3

Course Outcomes:

CO: 1 Students get sufficient information that clarifies modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.

CO: 2 Students realize the need to change their approach, so as to perceive our own environmental issues correctly, using practical approach based on observation and self-learning.

CO: 3 Students become conversant with the fact that there is a need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it.

CO: 4 Interpretation of different types of environmental pollution problems and designing of new solid waste management techniques usage

CO: 5 To get knowledge on various environmental acts and to engage all the students life - long learning of rain water harvesting

UNIT I

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

Natural Resources: Renewable and non-renewable energy 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 sub-surface – 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-pesticides problems, water logging, salinity, case studies.

Energy resources: Renewable and non-renewable energy resources

UNIT II

Ecosystems: Concept of an ecosystem. – Structure and functions 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: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity And Its Conservation : Introduction- Definition: genetic, species and ecosystem diversity – 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 Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

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UNIT III

Environmental Pollution: Definition, Causes, effects and its control measures of : Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and 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, Tsunami and landslides.

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people 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 Public awareness.

UNIT V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – 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.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

Reference Books:

1. Environmental studies by R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.
4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO: 2	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO: 3	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO: 4	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO: 5	PO1:Apply the knowledge of Basic science	1.2	1.2.1

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Year: II **Semester : I** **Branch of Study : Common to all**

Subject Code	Subject Name	L	T	P	Credits
19AHS9904	Communicative English II Lab	0	0	2	1

Course Outcomes:

CO: 1 Prioritize information from reading texts after selecting relevant and useful points.

CO: 2 Make formal structured presentations on academic topics using PPT slides with relevant graphical elements.

CO: 3 Participate in Group discussions using appropriate conventions and language strategies.

CO: 4 Paraphrase short academic text using suitable strategies and conventions.

CO: 5 Collaborate with a partner to make presentations and Project

UNIT I

Oral Presentation: Reading for presenting – strategies to select, compile and synthesize information for presentation; reading to recognize academic style. Listening for presentation strategies and answering questions- Formal presentations using PPT slides without graphic elements

UNIT II

Power point Presentation/Poster Presentation: Understand formal and informal styles; recognize the difference between facts and opinions. Following an argument/ logical flow of thought; answering questions, formal presentations using PPT slides with graphic elements.

UNIT III

Group discussion on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position. Identifying claims, evidences, views, opinions and stance/ position. Identifying views and opinions expressed by different speakers while listening to discussions.

UNIT IV

Reading for inferential comprehension. Group discussion; reaching consensus in group work(academic context). Understanding inferences; processing of information using specific context clues from the text.

UNIT V

Formal team presentations on academic/ general topics using PPT slides-identifying sections in project reports; understanding the purpose of each section; significance of references.

Reference Books:

1. Effective Technical Communication, Rizvi,Tata McGraw-Hill Education2007.
2. A Practical Course in Effective English Speaking skills, J.K.Gangal, PHI Learning Pvt Ltd, 2012.
3. A Course in Communication Skills, P.Kiranmai Dutt,Geetha Rajeevan,C.L.N.Prakash, 2008.
4. Technical Communication, Meenakshi Raman, Oxford University Press.
5. Professional Communication Skills, Er.A.K.Jain, Pravin S.R.Bhatia, Dr.A.M.Sheikh, S.Chand & Company Ltd, 2001.

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List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.1	10.1.1 10.1.2
CO: 2	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.3	10.3.1 10.3.2 .
CO: 3	PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9.2.	9.2.1 9.2.2 9.2.3
CO: 4	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	10.3	10.3.1 10.3.2
CO: 5	PO10 Able to comprehend and write effective reports and design documentation.	10.3	10.3.1 10.3.2

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Year: II **Semester : I** **Branch of Study : Common to all**

Subject Code	Subject Name	L	T	P	Credits
19AES0303	Design Thinking and Product Innovation Lab	0	0	2	1

Practice Problems use software wherever applicable.

1) (a) Study of mechanisms: linear motion to rotary motion and rotary motion to linear motion and their applications.
   (b) Study of eccentric, cam, linear actuator.
2) Study of motion transmission through belts, chains and gears.
3) Study of mechanical advantage through pulleys and other mechanisms.
4) Study of different electrical equipments such as mechanical calculators, automotive devices such as wiper.
5) To design a device for measurement of Temperature/ pressure.
6) Open any mechanical part to identify bad features and improve the design.
7) Exercise in 3D printing of a design
   Ex: Institute emblem, small toy car or any other item of student choice.
8) To design a device for Water Level Indicator.
9) Design and Simulation of a Hydraulic Shaper.
10) Design of simple pneumatic and hydraulic circuits using basic components.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1: Engineering knowledge	1.3	1.3.1
CO: 2	PO2: Modern tool usage	2.1	2.1.3
CO: 3	PO4: Conduct investigations of complex problems	4.1	4.1.2
CO: 4	PO2: Problem analysis	2.1	2.1.2
CO: 5	PO7: Environment and sustainability:	7.1	7.1.2

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Year: II Semester : I Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19APC0307	Material Science and Engineering Lab	0	0	2	1

Course Outcomes:

CO: 1 Identify various microstructures of steels and cast irons.
CO: 2 Visualize grains and grain boundaries
CO: 3 Evaluate hardness of treated and untreated steels.
CO: 4 Summarize the importance of hardening of steels.
CO: 5 Study the Micro structure of Heat treated steels.

List of Experiments:

1. Study of microstructure of pure metals – Iron, copper and aluminum.
2. Study of microstructure of low carbon steel, mild steel and high carbon steel.
3. Study of microstructure of cast irons.
4. Study of microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.
5. Study hardenability of steels by Jominy End Quench Test.
6. Study of microstructure of heat treated steels.
7. Find hardness of various untreated and treated steels.
8. Study of microstructure of ceramics, polymeric materials.

List of COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 5: Modern tool usage	5.5	5.5.2
CO: 2	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO: 3	PO 4: Conduct investigations of complex problems	4.3	4.3.1
CO: 4	PO 4: Conduct investigations of complex problems	4.1	4.1.4
CO: 5	PO 5: Modern tool usage	5.5	5.5.2

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Year: II Semester : I Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19ALC0303	Computer Aided Machine Drawing Lab	0	0	3	1.5

Course Outcomes:

CO: 1 Demonstrate the conventional representations of materials and machine components
CO: 2 Model riveted, welded and key joints using CAD system
CO: 3 Create solid models and sectional views of machine components
CO: 4 Generate solid models of machine parts and assemble them
CO: 5 Create manufacturing drawing with dimensional and geometric tolerances

The following contents are to be done by any 2D software package

Unit – I

Conventional representation of materials and components:
Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.
Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Unit – II
Welded joints: Lap joint and T joint with fillet, butt joint with conventions.
Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key. Shaft coupling, bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

Unit – III
The following contents to be done by any 3D software package
Sectional views: Creating solid models of complex machine parts and create sectional views.

Unit – IV
Assembly drawings: (Any four of the following using solid model software)
Lathe tool post, tool head of shaping machine, tail stock, machine vice, gate valve, carburettor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling,

Unit – V
Manufacturing drawing: Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Text Books:
1. K. L. Narayana, P. Kannaiah, A text book on Engineering Drawing, SciTech Publications, 2014
2. N. D. Bhatt, Machine Drawing, Charotar, 50/e, 2014.

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Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014

List of COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 3: Design/development of solutions	3.4	3.4.2
CO: 2	PO 2: Problem analysis	2.1	2.1.2
CO: 3	PO 3: Design/development of solutions	3.3	3.3.1
CO: 4	PO 5: Modern tool usage	5.1	5.1.2
CO: 5	PO 1: Engineering knowledge	1.1	1.1.2

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19ABS9915	Transform Techniques and Numerical Methods	3	0	0	3

Course Outcomes:

CO: 1 Apply the Laplace transform for solving differential equations (continuous systems)
CO: 2 Find the Fourier series of periodic signals
CO: 3 Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms
CO: 4 Solve linear/nonlinear algebraic and transcendental equations using numerical methods
CO: 5 Solve ordinary differential equations by Euler's method, modified Euler's method, Runge Kutta method, Predictor Corrector method and Milne's method

UNIT I
Laplace transforms:
Definition of Laplace transform, existence conditions, properties of Laplace transforms, inverse Laplace transforms, transforms of derivatives, transforms of integrals, multiplication by t^n, division by t, convolution theorem, periodic functions, unit step function, unit impulse function, applications to ordinary differential equations. (Without proofs).

UNIT II
Fourier series:
Dirichlet's conditions, Fourier series, conditions for a Fourier expansion, functions of any period, odd and even functions - half range series.

UNIT III
Fourier transforms:
Fourier integrals, Fourier cosine and sine integrals, Fourier transform, sine and cosine transform, properties, convolution theorem.

UNIT IV
Solution to algebraic equations:
Solution of polynomial and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method. finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT V
Numerical differentiation and integration:
Numerical Differentiation, numerical integration- trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Ordinary differential equations-Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations.

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

References

1. T.K.V.Iyengar, B.Krishna Gandhi and others, Engineering Mathematics-II, & Probability and Statistics, S.Chand Publishers
2. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO 2	PO1:Apply the knowledge of mathematics	1.1	1.1.2
CO 3	PO 2: First principles of mathematics.	2.2	2.2.2
CO 4	PO1: Knowledge of mathematics	1.3	1.3.1
CO 5	PO1: Knowledge of mathematics	1.1	1.1.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0309	Kinematics of Machinery	3	0	0	3

Course Outcomes:

CO: 1 To enable the students in selection of appropriate mechanisms.
CO: 2 To impart the clear idea in constructing velocity & acceleration diagrams for the given mechanism.
CO: 3 To provide an overview of straight line motion mechanisms, steering mechanisms and Hooke's joint.
CO: 4 To understand the kinematic analysis of gears & gear trains.
CO: 5 To develop the knowledge of kinematic analysis of cams.

UNIT I

Mechanisms, Machine and Structure:

Element or Link – Classification – Rigid Link, flexible and fluid link – Kinematic pair – Types – sliding, turning, rolling, screw and spherical pairs, Lower and Higher pairs, closed and open pairs – Constrained motion – completely, partially or successfully constrained motion, and incompletely constrained motion.

Kinematic chain – Degrees of freedom of planar mechanisms – inversion of mechanism – inversion of quadric cycle chain, single and double slider crank chain.

UNIT II

Velocity and Acceleration analysis of mechanisms:

Velocity Analysis:

Relative velocity method: Motion of Link – construction of velocity diagrams – determination of angular velocity of points and links – four bar chain, single slider crank chain and other simple mechanisms.

Instantaneous center method: Instantaneous center of rotation – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

Acceleration Analysis: Acceleration diagram for simple mechanisms – determination of acceleration of points and angular acceleration of links – Corioli's acceleration – Klein's construction..

UNIT III

Straight line motion mechanisms, Steering mechanisms, and Hooke's Joint:

Straight line motion mechanisms: Exact and approximate copiers and generated types – Peaucellier, Hart's and Scott Russell – Grosshopper, Watt, T-Chebicheff, Robert mechanisms.

Steering mechanisms: Condition for correct steering – Davis steering gear, Ackerman's steering gear. Hooke's Joint: Single and double Hooke's joint – velocity ratio, simple problems.

UNIT IV

Gears and Gear trains:

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Gears: Friction wheels and toothed gears – types – law of gearing – condition for constant velocity ratio for transmission of motion – forms of teeth – Cycloidal and involute profiles – velocity of sliding, path of contact, arc of contact and contact ratio – phenomena of interference – methods to avoid interference – condition for minimum number of teeth to avoid intereference.

Gear trains: Introduction – train value – types – simple, compound, reverted and epicyclic gear trains – methods of finding train value or velocity ratio of epicyclic gear trains – sun & planetary gear systems – differential gear of an automobile.

UNIT V

Cams:

Definitions – Cam and Follower – uses – types of followers and cams – radial cam terminology – types of follower motion – uniform velocity, simple harmonic, uniform acceleration and retardation motion – maximum velocity and maximum acceleration during outward and return strokes in the above cases.

Textbooks:

1. S.S.Rattan, Theory of Machines, Tata McGraw Hill Education (India) Pvt. Ltd.
2. R.S.Khurmi & J.K.Gupta, Theory of Mahines, S.Chand Publications.

References

1. Jagadish Lal, Theory of Mechanisms and Machines, Metropolitan company pvt. Ltd
2. R.K.Bansal, Theory of Machines, Lakshmi Publications.
3. Thomas Bevan, Theory of Machines, CBS.
4. P L Ballaney, Theory of Machines, Khanna Publishers.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Engineering knowledge	1.1.	1.1.2
CO 2	PO1: Engineering knowledge	1.1	1.1.2
CO 3	PO1: Engineering knowledge	1.1	1.1.1
CO 4	PO2: Problem analysis	2.4	2.4.1
CO 5	PO2: Problem analysis	2.4	2.4.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AES0505	Internet of Things (IoT)	2	0	0	2

Course Outcomes:

CO: 1 Interpret the vision of IoT from a global context
CO: 2 Determine the Market perspective of IoT
CO: 3 Compare and Contrast the use of Devices, Gateways and Data Management in IoT
CO: 4 Implement state of the art architecture in IoT
CO: 5 Illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints

UNIT I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.

UNIT II

M2M to IoT - A Market Perspective- Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview- Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT III

M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT IV

IoT Architecture-State of the Art - Introduction, State of the art.

UNIT V

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things.

Textbooks:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. (ISBN-13:978-0124076846).

References

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN-13: 978-8173719547)

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2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013. (ISBN-13: 978- 1430257400)P L Ballaney, Theory of Machines, Khanna Publishers.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 5: Modern Tool Usage	5.1	5.1.1
CO 2	PO 5: Modern Tool Usage	5.2	5.2.1
CO 3	PO 4: Conduct investigations of complex problems	4.3	4.3.1
CO 4	PO 3: Design/Development of Solutions	3.4	3.4.1
CO 5	PO 6: Engineer & Society	6.1	6.1.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0302	Mechanics of Materials	3	0	0	3

Course Outcomes:

CO: 1 Apply the concepts of stress and strain to machine numbers
CO: 2 Determine, shear forces, and bending moments in beams
CO: 3 To find slope and deflection in beams, determine shear forces and bending moments in beams
CO: 4 Estimate the stresses in machine members such as shafts and springs and design
CO: 5 Estimate the stresses in thin cylinders due to internal pressure

UNIT I

Stresses and Strains: Types of stresses and strains, stress-strain relations, stress-strain diagram for ductile and other materials, axial loaded bars of uniform and varying cross section, compound bars, relation between three elastic moduli, thermal stresses. Strain energy, resilience

Principal stresses and strains: Biaxial state of stress with and without shear - Mohr's Circle and analytical methods.

UNIT II

Analysis of Beams: Types of beams and loads, shear force and bending moment diagram for cantilever, simply supported and overhanging beams for different types of loadings, point of contra flexure, relation between shearing force and bending moment.

Bending Stresses: Flexural equation, bending stress distribution and efficiency of various cross sections of beams.

UNIT III

Deflection of Beams: Differential equations of the deflection curve, Slope and deflection: using double integration method, Macaulay's method and Moment area method for simply supported, cantilever and overhanging beams. Deflection under single and several loads.

UNIT IV

Torsional and shear stresses: Theory of pure torsion, Shear Stresses: Shear stress distribution for different cross sections of beams.

UNIT V

Buckling of Columns: Analysis of columns to evaluate buckling loads with different boundary conditions, Euler's formula and its limitations, Rankine's formula.

Thin Cylinders: hoop and stresses, longitudinal, cylindrical and spherical shells subjected to internal pressure calculation of volumetric strain.

Text Books :

1. F.P. Beer, E.R. Johnston, Jr & John. T. De Wolf, Mechanics of Materials, 7/e, Tata McGraw-Hill, 2016.
2. SS Rattan, Strength of materials, 3/e, Tata McGraw-Hill, 2016.

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Reference Books:

1. Timoshenko, Strength of Materials Part-I& II, 3/e, CBS Publishers, 2004.
2. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 2: Problem analysis:	2.1	2.1.3
CO: 3	PO 4: Conduct investigations of complexproblems	4.1	4.1.2
CO: 4	PO 2: Problem analysis:	2.1	2.1.2
CO: 5	PO 1: Engineering knowledge:	2.6	2.6.3

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0304	Manufacturing Technology	2	0	0	2

Course Outcomes:

CO: 1 Demonstrate different metal casting processes and gating systems
CO: 2 Classify working of various welding processes
CO: 3 Evaluate the forces and power requirements in rolling process
CO: 4 Apply the principles of various forging operations
CO: 5 Outline the manufacturing methods of plasticsand ceramics.

UNIT I

Introduction: Importance and selection of manufacturing processes.

Casting Processes: Introduction to casting process, process steps; pattern: types, materials and allowance; Cores 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: Introduction, nature of plastic deformation, hot and cold working, 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.

UNIT III

Forging: 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 IV

Material Joining Processes: 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, other fabrication processes. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies. Adhesive Bonding.

UNIT V

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.

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Text Books :

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

Reference Books:

1. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
3. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st Edition, Springer, 2010.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.6	1.3.1
CO: 2	PO 5: Modern tool usage	5.2	5.2.2
CO: 3	PO 2: Problem analysis	2.5	2.1.2
CO: 4	PO 5: Modern tool usage:	5.2	5.2.2
CO: 5	PO 7: Environment and sustainability	7.4	7.4.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0314	Fluid Mechanics & Hydraulic Machinery	3	0	0	3

Course Outcomes:

CO: 1 Interpret the behavior under static and dynamic conditions.
CO: 2 analyze one dimensional viscous flows using conservation laws for compressible and incompressible flows.
CO: 3 apply boundary layer flows for laminar and turbulent regimes.
CO: 4 explain Reynolds stresses and its application
CO: 5 explain different types of pumps and their application.

UNIT I

Fluid Statics: Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapor pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.
Fluid Kinematics: stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow.

UNIT II

Fluid Dynamics: surface and body forces – Euler's and Bernoulli's equations for flowing stream line, momentum equation and its application on force on pipe bend.
Conduit Flow: Reynold'sexperiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter and orifice meter, Flow nozzle and Turbine current meter.

UNIT III

Turbo Machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done efficiency, flow over radial vanes.
Hydroelectric Power Stations: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements.

UNIT IV

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube – theory – functions and efficiency.
Performance of Hydraulic Turbines: Unit and specific quantities, characteristics, governing of turbines, selection of type of turbine, cavitation and surge tank.

UNIT V

Pumps: Classification –Rotary & Reciprocating pumps – working – work done – manomertic head – loss efficiencies – specific speed – pumps in series and parallel – performance characteristic curves and NPSH.

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TEXT BOOKS :

1. Fluid Mechanics, FRANK M. WHITE, Mc. Graw Hill Education.
2. Fluid Mechanics, Hydraulic and Hydraulic Machines by Modi & Seth, Standard book house.
3. A Text of Fluid Mechanics and Hydraulic Machines by Dr. R. K. Bansal – Laxmi Publications (P) Ltd., New Delhi.
4. Mechanics of Fluids by Potter, Wiggert, Ramadan, M. M. M. Sarcar, Cengage Publishers.

REFERENCE BOOKS :

1. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
2. Principles of Fluid Mechanics and Fluid Machines by M. Narayana Pillai, Universities Press.
3. Fluid mechanics and fluid machines by Rajput, S.Chand & Co.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 2: Problem analysis	2.1	2.1.3
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 2: Problem analysis	2.1	2.1.2
CO: 5	PO 1: Engineering knowledge	2.6	2.6.3

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AMC9901	Biology for Engineers	3	0	0	0

Course Outcomes:

CO: 1 Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.

CO: 2 Explain about biomolecules, their structure, function and their role in the living organisms. How biomolecules are useful in Industry.

CO: 3 Brief about human physiology.

CO: 4 Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.

CO: 5 Know about application of biological principles in different technologies for the production of medicines and pharmaceutical molecules through transgenic microbes, plants and animals

UNIT I

Evolution: Different patterns of evolution, Darwin's theory of evolution, Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification, Tissue Engineering.

UNIT II

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

UNIT III

Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle, Central Nerves System and Excretory system.

UNIT IV

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

UNIT V

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, Properties and Classification of virus, Immune response to virus, Definitions-Pandemic, Epidemic and outbreak, pandemic alert system ranges, Prevention of pandemic disease and pandemic preparation.

TEXT BOOKS :

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications.
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017.

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REFERENCE BOOKS :

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A Global Approach", Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed.. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology – 2014.
6. Richard Dawkins, River Out of Eden: A Darwinian View of Life Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 2	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 3	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 4	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 5	PO 1: Apply the knowledge of basic science	1.2	1.2.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0315	Fluid Mechanics & Hydraulic Machinery Lab	0	0	2	1

Course Outcomes:

CO: 1 Interpret the behavior under static and dynamic conditions.
CO: 2 analyze one dimensional viscous flows using conservation laws for compressible and incompressible flows.
CO: 3 apply boundary layer flows for laminar and turbulent regimes.
CO: 4 explain Reynolds stresses and its application
CO: 5 explain different types of pumps and their application.

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Varification of Bernoulli‟s equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Engineering knowledge	1.1.	1.1.2
CO 2	PO1: Engineering knowledge	1.1	1.1.2
CO 3	PO1: Engineering knowledge	1.1	1.1.1
CO 4	PO2: Problem analysis	2.4	2.4.1
CO 5	PO2: Problem analysis	2.4	2.4.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AES0506	Internet of Things Lab (IoT Lab)	0	0	2	1

Lab Experiments:

1. Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board.
2. Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors.
3. Control any two actuators connected to the development board using Bluetooth.
4. Read data from sensor and send it to a requesting client. (using socket communication) Note: The client and server should be connected to same local area network.
5. Create any cloud platform account, explore IoT services and register a thing on the platform.
6. Push sensor data to cloud.
7. Control an actuator through cloud.
8. Access the data pushed from sensor to cloud and apply any data analytics or visualization services.
9. Create a mobile app to control an actuator.
10. Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it (Mini Project).

Text Book:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
2. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

Reference sites:
https://www.arduino.cc/,https://www.raspberrypi.org/

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

- Choose the sensors and actuators for an IoT application.
- Select protocols for a specific IoT application.
- Utilize the cloud platform and APIs for IoT application.
- Experiment with embedded boards for creating IoT prototypes.

Design a solution for a given IoT application

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 5: Modern Tool Usage	5.1	5.1.1
CO 2	PO 5: Modern Tool Usage	5.2	5.2.1
CO 3	PO 4: Conduct investigations of complex Problem	4.3	4.3.1
CO 4	PO 3: Design/Development of Solutions	3.4	3.4.1
CO 5	PO 6: Engineer & Society	6.1	6.1.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0305	Manufacturing Technology Lab	0	0	3	1.5

Course Outcomes:

CO: 1 Fabricate different types of components using various manufacturing techniques.
CO: 2 Carry out Pattern preparation and Estimate the Sand properties
CO: 3 Carry out the Welding process to join the components
CO: 4 Carry out Blanking & Piercing operation
CO: 5 Adapt material forming methods.

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) Arc Welding: Lap & Butt Joint - 2 Exercises
   b) Spot Welding - 1 Exercise
   c) TIG Welding - 1 Exercise
   d) Plasma welding and Brazing - 2 Exercises (Water Plasma Device).
3. **MECHANICAL PRESS WORKING**
   a) Blanking & Piercing operation and study of simple, compound and progressive press tool.
   b) Hydraulic Press: Deep drawing and extrusion operation.
   c) Bending and other operations.

COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO 5: Modern tool usage	5.2	5.2.2
CO2	PO 1: Engineering knowledge	1.2	1.2.2
CO3	PO 5: Modern tool usage	5.2	5.2.2
CO4	PO 5: Modern tool usage	5.2	5.2.2
CO5	PO 1: Engineering knowledge PO 7: Environment and sustainability	1.6 7.2	1.3.1 7.2.1

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0325	Dynamics of Machines	3	0	0	3

Course Outcomes:

CO: 1 To understand the application of friction in pivots, collars, clutches, brakes, and dynamometers, and also to solve the numerical problems

CO: 2 To understand gyroscopic effect on Aeroplane, ship, four wheel and two-wheel vehicles. To design a flywheel for reciprocating engine and punching press.

CO: 3 To understand the working of various types of governors and to analyze the forces acting on them. To solve numerical problems on balancing of rotating masses

CO: 4 To understand that effect of primary and secondary balancing of reciprocating masses in locomotive engines, V-engine, inline engines and Radial engines

CO: 5 To understand the concept of different types of vibratory systems and to perform simple calculations of vibration systems

UNIT I

Friction:
Types of friction, inclined plane, screw friction, screw jack, Journal bearing, concept of uniform pressure and uniform wear, pivot bearings – flat, conical and trapezoidal, flat collar bearings, friction clutches – flat, conical and centrifugal, Brakes – Block or Shoe Brake, Band Brake, Band and Block Brake, Internal Expanding Shoe Brake, Effect of Braking on vehicle, general description and method of operation of Dynamometers.

UNIT II

Gyroscope:
Effect of gyroscopic couple on the stability of moving Aeroplane, ship, motor car and motor cycle.

Fluctuation of Energy:
Turning moment diagrams for steam engine, IC Engine and multi cylinder engine, coefficient of Fluctuation of energy, coefficient of Fluctuation of speed, design of Fly wheels for reciprocating engines, design of Fly wheels for punching machines.

UNIT III

Governors:
Watt governor, dead weight governor – Porter and Proell governors. Spring loaded governors – Hartnell, Hartung and Wilson Hartnell governors. Sensitiveness, isochronism and hunting. Effort and power of a governor.

Balancing of rotating masses:
Single in single plane, multiple masses in single plane, multiple masses indifferent planes.

UNIT IV

Balancing of Reciprocating masses:
Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Balancing of Locomotives, Effects of Partial Balancing in Locomotives, Balancing of Inline Engines, V-engines, and Radial Engines. Unbalanced forces and couples for primary and secondary balancing.

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UNIT V

Vibrations:

Free Longitudinal Vibrations, Inertia Effect of the Mass of Spring, Damped Vibrations, Forced Vibrations, Forced-damped Vibrations, Transverse Vibrations of Shaft due to Single Load, uniformly distributed Load and Several Loads, Dunkerly‟s method, Raleigh‟s method, Whirling of Shafts, Free Torsional Vibrations in Single Rotor, Two-rotor and Three-rotor Systems, Inertia Effect of Mass of Shaft, Torsionally Equivalent Shaft.

Text Books:

1. Theory of Machines, S.S. Rattan, Tata McGraw Hill.
2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

Reference Books:

1. Theory of Machines, Thomas Bevan, Pearson.
2. The theory of Machines, Ballaney, Kanna Publishers
3. Theory of Machines and Mechanisms of Shigley et.al. Oxford International.
4. Theory of Machines, Kinematics and Dynamics sadhu gingh, Pearson
5. A Text Book of Theory of Machines. R. K. Bansal, Laxmi Publications
6. Theory of Mechanisms and Machines, Jagadish Lal, Metropolitan company pvt. Ltd

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 1: Engineering knowledge	1.4	1.4.1
CO 2	PO 2: Problem analysis	2.1	2.1.3
CO 3	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO 4	PO 2: Problem analysis	2.1	2.1.2
CO 5	PO 1: Engineering knowledge	1.4	1.4.1

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0310	Thermal Engineering – I	3	0	0	3

Course Outcomes:

CO: 1 To student can know working of both S.I and C.I engines with the help of indicator diagrams.
CO: 2 Student can understand the fuel supply systems, cooling, lubrication and ignition systems
CO: 3 Student can understand the flame propagation inside the cylinder, stages of combustion in S.I and C.I engines
CO: 4 To familiar with indicated power, brake power and friction power and their methods of measurement
CO: 5 The working of reciprocating and rotary air compressors. Student can calculate work done by single and multistage reciprocating air compressors.

UNIT I

I.C. ENGINES: Definition of Engine And Heat Engine, I.C Engine Classification – Parts of I.C. Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C. Engines SI & CI Engines, Valve and Port Timing Diagrams.

UNIT II

Fuel System: S.I. Engine: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Gasoline Injection Systems.. Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System; Lubrication Systems-Flash, Pressurized and Mist Lubrication. Ignition System: Function Of An Ignition System, Battery coil Ignition System, Magneto Coil Ignition System, Electronic Ignition System using Contact Breaker, Electronic Ignition using Contact Triggers – Spark Advance And Retard Mechanism.

UNIT III

Fuels and Combustion: S I engine: Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers. C.I. Engines: Stages Of Combustion – Delay Period And Its Importance – Effect Of Engine Variables – Diesel Knock– Combustion Chambers (DI And IDI), Fuel Requirements And Fuel Rating.

UNIT IV

Testing and Performance : Parameters of Performance - Measurement of Cylinder Pressure, Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Determination of Frictional Losses And Indicated Power – Performance Test – Heat Balance Sheet and Chart.

UNIT V

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors.

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GAS TURBINES: Simple Gas Turbine Plant – Ideal Cycle, Essential Components – Parameters of Performance. jet propulsion: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram

Text Books:

1. Internal Combustion Engines / V. Ganesan- TMH, 4th Edition,2012
2. Thermal Engineering / Rajput / Lakshmi Publications, 9th Edition,2013

Reference Books:

1. I.C. Engines fundamentals, Heywood, McGrawHIll, 1st Edition,2011
2. IC Engines – Mathur& Sharma – DhanpathRai& Sons, ,2010
3. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI, 2nd Edition,2009
4. Thermal Engineering, Rudramoorthy – TMH, 10th Edition,2010
5. Thermodynamics & Heat Engines, B. Yadav, Central publishing house., Allahabad, 2002
6. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand, 15th Edition,2012

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 2: Problem analysis	2.1	2.1.3
CO: 3	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO: 4	PO 2: Problem analysis	2.1	2.1.2
CO: 5	PO 1: Engineering knowledge:	2.6	2.6.3

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MECHANICAL ENGINEERING (ME)

Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0316	Design of Machine Members - 1	3	0	0	3

Course Outcomes:

CO: 1 To apply design procedures using theories of failure for different elements
CO: 2 Able to design simple components under cyclic loading using Goodman's and Soderberg's criterions
CO: 3 Able to design riveted joints with different configuration, boiler shell joint design and eccentric loading design of riveted joints
CO: 4 To design cotter joint, knuckle joint and shafts
CO: 5 To design various rigid and flexible shaft couplings

UNIT I

INTRODUCTION: General considerations of design, design process. Selection of Engineering Materials - properties –Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability. STRESSES IN MACHINE MEMBERS: Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Theories of failure – factor of safety.

UNIT II

DESIGN FOR FLUCTUATING LOADS: Stress concentration –notch sensitivity – Design for fluctuating stresses – Estimation of Endurance strength – Goodman's line – Soderberg's line. Design of components for finite and infinite life.

UNIT III

DESIGN OF RIVETED JOINTS: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints. DESIGN OF BOLTED JOINTS: Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

UNIT IV

DESIGN OF COTTERS AND KNUCKLE JOINTS: Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints DESIGN OF SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads.

UNIT V

DESIGN OF KEYS AND COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

Text Books:

1. Machine Design, Schaum'sseries, TMH Publishers, NewDelhi, 1st edition, 2011
2. Machine Design, R.S. Kurmi and J.K. Gupta, S.Chand Publishers, NewDelhi

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Reference Books:

1. Machine Design, R.K.Jain, KhannaPublishaers,New Delhi.
2. Machine Design, SadhuSingh, KhannaPublishers, NewDelhi
3. Mechanical Engineering Design, JosephE.Shigely,TMH Publishers,NewDelhi, 9th edition, 2011 R
4. Design of Machine Elements, M.F. Spotts, PHIPublishers, NewDelhi.
5. Machine Design, Pandya and Shah, CharotarPublishers,Anand, 17th edition, 2009
6. Machine Design, R.L. Norton, Tata McGrawHillPublishers, 2nd edition, 2002
7. Machine Design by Groover – CBS Publications, 5th edition, 2012.
8. Machine Design Data Book, V B Bhandari, McGraw Hill,2014

COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO 5: Modern tool usage	5.2	5.2.2
CO2	PO 1: Engineering knowledge	1.2	1.2.2
CO3	PO 5: Modern tool usage	5.2	5.2.2
CO4	PO 5: Modern tool usage	5.2	5.2.2
CO5	PO 1: Engineering knowledge PO 7: Environment and sustainability	1.6 7.2	1.3.1 7.2.1

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MECHANICAL ENGINEERING (ME)

Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0324	Machine Tools	3	0	0	3

Course Outcomes:

CO: 1 To understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation
CO: 2 To understand the basic concepts of turning.
CO: 3 To understand the basic principle of drilling, shaping and planning operation, parts of the drilling
CO: 4 To able to understand the principle of milling, grinding, Lapping, Honing and Broaching operation
CO: 5 Tto understand the design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping

UNIT I

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, heat generation, tool life, coolants, machinability – economics of machining. cutting Tool materials and cutting fluids –types and characteristics.

UNIT II

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread turning and attachments for Lathes.Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design

UNIT III

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring tools – machining time calculation. Shaping, Slotting and Planning machines –Principles of working – Principal parts – specification, classification, Operations performed. Machining time calculations.

UNIT IV

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features – machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines. Grinding machine –Theory

of grinding – classification– cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel. Static and dynamic balancing of a wheel Truing and Dressing of wheels. Lapping, Honing and Broaching machines – comparison of grinding, lapping and honing. machining time calculations.

UNIT V

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices, Typical examples of jigs and fixtures Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications.

Text Books:

1. Workshop Technology – Vol II, B.S.RaghuVamshi, Dhanpat Rai & Co, 10th edition, 2013
2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition, 2012

Reference Books:

1. Manufacturing Technology-Kalpakzian- Pearson
2. Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2nd edition, 2012
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st edition, 2001
4. Production Technology by K.L.Narayana, IK International Pub.
5. Machining and machine tools by AB. Chattopadyay, WileyEdn,2013
6. Unconventional Machining process by V.K.Jain, Allied Pub.
7. Manufacturing technology Vol II by P.N. Rao, Tata McGraw Hill, 4th edition, 2013

COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO 5: Modern tool usage	5.2	5.2.2
CO2	PO 1: Engineering knowledge	1.2	1.2.2
CO3	PO 5: Modern tool usage	5.2	5.2.2
CO4	PO 5: Modern tool usage	5.2	5.2.2
CO5	PO 1: Engineering knowledge PO 7: Environment and sustainability	1.6 7.2	1.3.1 7.2.1

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0304	Nano Technology	3	0	0	3

Course Outcomes:
CO: 1 To identify the essential concepts used in nanotechnology
CO: 2 To identify the materials, properties
CO: 3 To Derive charecterization techniques
CO: 4 To Characterization of carbon allotropes, synthesis of diamond.
CO: 5 To derive Applications in material science, biology and medicine.

UNIT-I

INTRODUCTION: History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.

PROPERTIES OF MATERIALS: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-II

SYNTHESIS AND FABRICATION: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures

UNIT-III

CHARECTERIZATION TECHNIQUES: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy

UNIT-IV

CARBON NANO TECHNOLOGY: Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, applications of carbon nano tubes.

UNIT-V

APPLICATIONS OF NANO TECHNOLOGY: Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin fins, applications of quantum dots.

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TEXT BOOK:

1. Nano science and nano technology / M.S Ramachandra Rao, Shubra Singh/Wiley publishers.
2. Introduction to Nanotechnology by Risal Singh, Shipra Mital Gupta, Oxford Higher Education, First Publication 2016.

REFERENCE BOOKS:

1. Introduction to Nano Technology /Charles P. Poole, Jr., Frank J.Owens/Wiley publishers.
2. Nanotechnology /Jermy J Ramsden/Elsevier publishers
3. Nano Materials/A.K.Bandyopadhyay/ New Age
4. Nano The Essentials, T.Pradeep, McGrawHill, 2014
5. Nanotechnology the Science of Small / M.A Shah, K.A Shah/Wiley Publisher

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 2: Problem analysis	2.5	2.1.3
CO: 2	PO 1: Engineering knowledge PO 2: Problem analysis	2.2	2.2.3
CO: 3	PO 1: Engineering knowledge PO 2: Problem analysis	2.1	2.1.3
CO: 4	PO 1: Engineering knowledge PO 2: Problem analysis PO 3: Design/development of solutions	2.2	2.2.3
CO: 5	PO 1: Engineering knowledge PO 2: Problem analysis	2.4	2.4.3

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0305	Composite materials	3	0	0	3

Course Outcomes:

CO: 1 To study matrix material, reinforcements of polymer matrix composites, MMC and ceramic matrix composites..
CO: 2 To develop knowledge on manufacturing methods of composites
CO: 3 To develop knowledge on processing techniques and applications of PMCs
CO: 4 To develop knowledge on processing techniques and applications of PMCs
CO: 5 To develop knowledge on processing techniques and applications of CMCs and Carbon- carbon composites

Unit I: Introduction: 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: Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface. Measurement of interface strength, Characterization of systems; carbon fibre /epoxy, glass fibre / polyester, etc.

Unit III: Processing of Polymer Matrix Composites: Thermoset matrix composites: hand layup, spray, filament winding, Pultrusion, resin transfer moulding, autoclave moulding - bag moulding, compression moulding with Bulk Moulding Compound and sheet Moulding Compound – thermoplastic matrix composites – film stacking, diaphragm forming, thermoplastic tape laying, injection moulding.

Unit IV: Processing of Metal Matrix Composites: Metallic matrices: aluminium, titanium, magnesium, copper alloys – processing of MMCs: liquid state, Solid state, fabrication techniques – diffusion bonding – powder metallurgy techniques- interfaces in MMCs – mechanical properties – machining of MMCs – Applications.

Unit V: Processing of Ceramic Matrix Composites and Carbon-carbon Composites: Processing of CMCs: cold pressing, sintering, reaction bonding, liquid infiltration, chemical reaction techniques: chemical vapour deposition, chemical vapour impregnation, mechanical properties and applications of CMCs – Carbon-carbon Composites –applications.

Text Books and Reference Books:

1. Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford University Press, 1994
2. Mechanics of Composite Materials, R. M. Jones, Mc GrawHill Company, New York, 1975
3. Mechanics of Composite Materials, Second Edition (Mechanical Engineering)- Autar K. Kaw, Publisher: CRC

4. .Mallick, P.K. and Newman.S., Composite Materials Technology, Hanser Publishers,2003.
5. Seamour, E.B. Modern Plastics Technology, Prentice Hall,2002
6. ASM Handbook – Composites, Vol-21, 2001, ISBN: 978-0-87170-703-1.
7. Composite Materials Science and Engineering, Krishan K. Chawla, Springer, 2009

Additional Sources

Youtube: https://nptel.ac.in/courses/112/104/112104229/

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 1: Engineering knowledge	1.3	1.3.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 1: Engineering knowledge	1.3	1.3.1
CO: 5	PO 1: Engineering knowledge	1.3	1.3.1

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0306	Renewable Energy Technologies	3	0	0	3

Course Outcomes:

CO: 1 Explain the current energy scenario and requirement of migration to renewable energy sources
CO: 2 To understand role significance of solar energy
CO: 3 To provide importance of Wind Energy
CO: 4 To understand the role of ocean energy in the Energy Generation
CO: 5 To understand role of hydrogen in non conventional energy

UNIT I

Classification of Energy:

Energy chain and common forms of usable energy- Present energy scenario- World energy status- Energy scenario in India- Introduction to renewable energy resources- Introduction to solar Energy- Energy from sun- Spectral distribution of Solar radiation- Instruments for measurement of solar radiation.

UNIT II

Solar Energy

Solar Radiation, Measurements of Solar Radiation, Flat Plate and Concentrating Collectors, Solar Direct Thermal Applications, Solar Thermal Power Generation, Fundamentals of Solar Photo Voltaic Conversion, Solar Cells, Solar PV Power Generation, Solar PV Applications.

UNIT III

Bio Energy Sources:

Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gasdigesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

Wind Energy:

Wind Energy Estimation, Types of Wind Energy Systems, Performance, Site Selection, Details of Wind Turbine Generator.

UNIT IV

Ocean Energy:

Ocean Thermal Energy Conversion (OTEC), Principle of operation, development of OTEC plants, Tidal and wave energy, Potential and conversion techniques, mini-hydel power plants.

Geothermal Energy:

Resources, types of wells, methods of harnessing the energy, scope in India.

Unit – V:

Hydrogen Energy:

Properties of hydrogen as fuel, Hydrogen pathways introduction-current uses, general introduction to infrastructure requirement for hydrogen production, storage, dispensing and utilization, and hydrogen production plants.

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MECHANICAL ENGINEERING (ME)

Textbooks:

1. Non-Conventional Energy Sources /G.D. Rai.
2. Reneweble energy resources: Tiwari and ghosal, Narosa publication.
3. Non conventional Energy Sources, Khanna Publication.

References:

1. Non-Conventional Energy Resources, B.H. Khan, McGrawHIll, 2015.
2. Principles of Solar Energy/ Frank Krieth & John F Kreider.
3. Fang Lin You, Hong ye (2012), Renewable Energy Systems, Advanced conversion technologies and applications, CRC Press
4. John.A.Duffie, William A.Beckman (2013), Solar Engineering of Thermal processes, Wiley
5. Godfrey Boyle (2012), Renewable Energy, power for a sustainable future, Oxford University Press.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 5: Modern tool usage	5.2	5.2.2
CO: 3	PO 5: Modern tool usage	5.2	5.1.2
CO: 4	PO 5: Modern tool usage	5.2	5.2.2
CO: 5	PO 1: Engineering knowledge	1.6	1.3.1

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MECHANICAL ENGINEERING (ME)

Year: III **Semester : I** **Branch of Study : Common to all**

Subject Code	Subject Name	L	T	P	Credits
19AHSMB01	Managerial Economics and Financial Analysis	3	0	0	3

Course Outcomes:

CO: 1 Understand the fundamentals of Economics and Managerial economics viz., Demand, Production, cost, revenue and markets.
CO: 2 Apply the Concept of Production cost and revenues for effective Business decision
CO: 3 Analyze how to invest their capital and maximize returns.
CO: 4 Evaluate the capital budgeting techniques.
CO: 5 Define the concepts related to financial accounting and management and able to develop the accounting statements and evaluate the financial performance of business entity

UNIT - I Managerial Economics

Introduction – meaning, nature, meaning, significance, functions, and advantages, ME and its role in other fields. Demand - Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing forecasting, Methods.

UNIT - II Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. 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 & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT - III Business Organizations and Markets

Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV Capital Budgeting

Introduction to Capital, Sources of Capital. Short-term and Long-term Capital : Working capital, types, Estimating Working capital requirements. Capital Budgeting – Features, Proposals, Time value of money. Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), and Internal Rate Return (IRR) Method (simple problems).

UNIT - V Financial Accounting and Analysis

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, 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.

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

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Reference Books:

1. Ahuja Hl Managerial economics Schand,3/e,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, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market
https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
https://www.slideshare.net/ashu1983/financial-accounting.

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0501	Artificial Intelligence	3	0	0	3

Course Outcomes:
CO: 1 Apply searching techniques for solving a problem
CO: 2 Design Intelligent Agents
CO: 3 Develop Natural Language Interface for Machines
CO: 4 Design mini robots
CO: 5 Summarize past, present and future of Artificial Intelligence

UNIT I
Introduction: What is AI, Foundations of AI, History of AI, The State of Art.
Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT II
Solving Problems by searching: Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

UNIT III
Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL
Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

UNIT IV
Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition
Perception: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

UNIT V
Robotics: Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains
Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

Textbook:
1. Stuart J.Russell, Peter Norvig, “Artificial Intelligence A Modern Approach”, 3rd Edition, Pearson Education, 2019.

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References:

Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.

Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0416	Sensor Networks	3	0	0	3

Course Outcomes:

CO: 1 Understand the concepts of Converters and Sensor data acquisitionsystems
CO: 2 Understand the concepts of Sensor Measurements in Structural Monitoring
CO: 3 Understand the concepts of commonly used sensing technologies and algorithms
CO: 4 Understand the concepts of Piezoelectric transducers for assessing and monitoring infrastructures
CO: 5 Understand the concepts of Fiber optic sensors for assessing and monitoring infrastructures

Unit-1 Sensor data acquisition systems and architectures

Introduction, General measurement system, Analog-to-digital converter architectures-Different types of ADCs – parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC Digital-to-analog conversion-Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Data acquisition systems-Analog Systems-Digital Systems.

Unit-II Sensors and Sensing Technology for Structural Monitoring

Introduction, Sensor Types, Sensor Measurements in Structural Monitoring- Structural Responses- Environmental Quantities- Operational Quantities- Typical Quantities for Bridge Monitoring- Fibre Optic Sensors- Classification of Fibre Optic Sensors- Typical Fibre Optic Sensors in SHM- Fibre Optic Sensors for Structural Monitoring- Wireless Sensors- Components of Wireless Sensors- Field Deployment in Civil Infrastructure.

Unit-III Commonly used sensors for civil infrastructures and their associated algorithms

Introduction, commonly used sensing technologies- Displacement-Strain-Acceleration-Environment **Associated algorithms-** Displacement sensors- Strain gages- Environmental measurements- **Examples of continuous monitoring systems.**

Unit-IV Piezoelectric transducers for assessing and monitoring civil infrastructures

Introduction, Principle of piezoelectricity, piezoelectric transducers for SHM applications, Bonding effects, Limitations of piezoelectric transducers, SHM techniques using piezoelectric transducers, Applications of piezoelectric transducer-based SHM.

Unit-V Fiber optic sensors for assessing and monitoring civil infrastructures

Introduction, Optical fiber concepts, Sensing mechanisms, Sensor packaging, Cables, connectors, and splicing, **Common optical fiber sensors-** Coherent interferometers, Low-coherence interferometers, Fiber Bragg gratings.

Text Books:

1. "Sensor Technologies for Civil Infrastructures", Volume 1 Sensing Hardware and Data Collection Methods for Performance Assessment Woodhead Publishing in Civil and Structural Engineering Ming L. Wang Jerome P. Lynch Hardcover ISBN: 9780857094322

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2. Wireless Sensor Networks for Civil Infrastructure Monitoring: A Best Practice Guide ICE Publishing David Rodenas-Herráiz, Kenichi Soga, Paul R A Fidler and Nicholas de Battista

References:

1. Ghatak A and Thyagarajan K. (1998) Introduction to Fiber Optics; Cambridge University Press: Cambridge, UK.
2. Barthorpe, R.J. and Worden, K. (2009) Sensor Placement Optimization. *Encyclopaedia of Structural Health Monitoring*, Boller, Chang and Fujino (ed.), John Wiley & Sons, Chichester, UK.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering Knowledge	1.4	1.4.1
CO: 2	PO 2: Problem Analysis	2.4	2.4.3
CO: 3	PO 2: Problem Analysis	2.4	2.4.3
CO: 4	PO 3: Design/Development of solutions	3.4	3.4.2
CO: 5	PO 3: Design/Development of solutions	3.4	3.4.2

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MECHANICAL ENGINEERING (ME)

Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AMC9902	Constitution of India	2	0	0	0

Course Outcomes:

CO: 1 Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO: 2 Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO: 3 Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO: 4 Discuss the Powers and functions of Governor, President, Judiciary.

CO: 5 Discuss the functions of local administration bodies

Unit:1 **4 hrs**

History of Making of the Indian Constitution - History Drafting Committee, (Composition & Working)

Unit:2 **8 hrs**

Philosophy of the Indian Constitution - Preamble Salient Features

Unit:3 **8hrs**

Contours of Constitutional Rights & Duties - Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.

Unit:4 **8hrs**

Organs of Governance - Parliament – Composition - Qualifications and Disqualifications - Powers and Functions - Executive, President, Governor - Council of Ministers -Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.

Unit:5 **8hrs**

Local Administration - District's Administration head: Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZillaPachayat - Elected officials and their roles, CEO Zilla Panchayat: Position and role - Block level: Organizational Hierarchy (Different departments) - Village level: Role of Elected and Appointed officials - Importance of grass root democracy.

Suggested books for reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO 1	PO 6: The engineer and society	6.2.	6.2.1
CO 2	PO 6: The engineer and society	6.2.	6.2.1
CO 3	PO 6: The engineer and society	6.2.	6.2.1
CO 4	PO 6: The engineer and society	6.2.	6.2.1
CO 5	PO 6: The engineer and society	6.2	6.1.1

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0311	Thermal Engineering Lab	0	0	2	1

Course Outcomes:

CO: 1 Understand different parts and mechanisms of IC Engine.
CO: 2 To understand the working principle of two and four stroke of IC Engine.
CO: 3 To understand the working principle and operation of diesel and petrol engine.
CO: 4 TO evaluate the performance characteristics of IC Engine and air compressor.
CO: 5 To understand measurements of engine emissions and study of boilers.

Any Ten experiments from the following

List of Experiments:

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines for CI Engines
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.
12. Engine Emission Measurement for SI & CI Engines.

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0305	Machine Tools Lab	0	0	2	1

Course Outcomes:

CO: 1 To apply knowledge of tool materials and cutting fluids in the machine shop
CO: 2 To develop the hands-on experience on different machining processes that will enable them to work in a typical machine shop.
CO: 3 To apply knowledge of metal cutting parameters, tool wear mechanisms
CO: 4 To understand the basic calculations of machining parameters.
CO: 5 To develop the practical knowledge on groove cutting, gear cutting

List of Experiments:

1. Demonstration of construction & operations of general-purpose machines: Lathe, drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planning
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Job on Cylindrical and Surface Grinding
9. Job on Grinding of Tool angles.

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Year: III **Semester : I** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0315	Computer Aided Drafting Lab	0	0	2	1

Course Outcomes:

CO: 1 To understand the basic elements of Computer Aided Drafting
CO: 2 To aquire knowledge of drafting packages
CO: 3 To understand the drafting features
CO: 4 To practice drafting of solids and perspective views
CO: 5 To practice drafting of Orthographic views

List of Experiments:

I Introduction to Computer Aided Drafting software packages.

II. Practice on basic elements of a Computer Aided Drafting packages

III. Practice on features of a Computer Aided Drafting package

IV Drafting of Solids, Intersection of Solids

V Drafting of Perspective views

VI Drafting of Orthographic views of simple parts

Note: Any of the standard Software Packages like – Pro-E, Uni – Graphics, Catia …. Etc

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0316	Design of Machine Members – II	3	1	0	4

Course Outcomes:

CO: 1 To design crane hooks, C-clamps and various belt, rope and chain drives
CO: 2 Design helical sprigs for two wheel vehicle and laminated springs for trucks
CO: 3 Design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings
CO: 4 Design spur and helical gears for different input conditions
CO: 5 Design engine components like Cylinder, piston, connecting rod and crankshaft

UNIT I

DESIGN OF CURVED BEAMS: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps. DESIGN OF POWER TRANSMISSIONS SYSTEMS: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

UNIT II

DESIGN OF MECHANICAL SPRINGS: Stress and deflections of helical Springs-Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Design of leaf springs. DESIGN OF POWER SCREWS: Design of screw-Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

UNIT III

DESIGN OF BEARINGS: Types of Journal bearings – Lubrication – bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings

UNIT IV

DESIGN OF SPUR & HELICAL GEARS: Spur gears- Helical gears – Bending strength – Design analysis of spur and Helical gears – Estimation of centre distance, module and face width. Check for dynamic and wear considerations

UNIT V

DESIGN OF IC ENGINE PARTS: Pistons– Design of piston. Cylinder, Connecting Rod.

Text Books:

1. Mechanical Engineering Design, JosephE. Shigely, TMH Publishers, NewDelhi, 9th edition, 2010.
2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

Reference Books:

1. Machine Design, Schaum's series, TMH Publishers, New Delhi, 1st edition, 2011
2. Design ofMachine Elements, V.B. Bhandari, TMH Publishers, NewDelhi, 2nd edition, 2013.
3. Machine Design, Sadhu Singh, Khanna Publishers, NewDelhi
4. Design of Machine Elements, M.F. Spotts, PHI Publishers, NewDelhi.

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0317	Heat Transfer	3	0	0	3

Course Outcomes:

CO: 1 To understand the concept of modes of heat transfer and to solve problems on conduction heat transfer.
CO: 2 To understand heat transfer through extended surfaces and solve the problems in 1-D transient conduction heat transfer.
CO: 3 To understand concept of the convection heat transfer and to solve practical problems on forced and natural convection heat transfer.
CO: 4 Calculate heat transfer in boiling, condensation and understand principle behind heat exchangers and solve problems using LMTD and NTU methods.
CO: 5 Understand basic concepts of radiation heat transfer from black and gray bodies and solve problems involving radiation shields.

Unit I

Introduction: Modes and Mechanisms of Heat Transfer – Basic Laws of Heat Transfer – General Applications of Heat Transfer.
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.
One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy –Thickness of Insulation / Critical Radius – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation.

Unit II

Heat Transfer in Extended Surface (Fins) – Types, Fin Materials, Applications , efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.
One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance – Significance of Biot and Fourier Numbers – Chart Solutions of Transient Conduction Systems – Problems on Semi-infinite Body.

Unit III

Heat Convective Transfer: Dimensional Analysis – Buckingham II Theorem and its Application for Developing Semi – Empirical Non-Dimensional Correlations for Convective Heat Transfer – Significance of Non-Dimensional Numbers – Concepts of Continuity, Momentum and Energy Equations.
Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over – Flat Plates, Cylinders and Spheres.
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.

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Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate – Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

Unit IV

Heat Transfer with Phase Change:
Boiling: Pool Boiling – Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.
Condensation: Filmwise and Dropwise Condensation – Nusselt's Theory of Condensation on a Vertical Plate – Film Condensation on Vertical and Horizontal Cylinders Using Empirical Correlations.

Unit V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation – Irradiation – Total and Monochromatic Quantities– Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann – Heat Exchange Between Two Black Bodies –Concepts of Shape Factor – Emissivity – Heat Exchange Between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

Text Books:

1. Heat and Mass Transfer, by Sachdeva, New age International.
2. Heat and Mass Transfer by Y.A Cengel, A J Ghajar, Mc Graw Hill education,2011.
3. Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2001.

Reference Books:

1. Heat Transfer, P.K.Nag, 3/e, TMH, 2011.
2. Fundamentals of Heat and Mass Transfer, Kondandaraman, C.P., 3/e, New Age Publ.
3. Heat Transfer, Holman.J.P, 10/e, TMH, 2012.
4. Introduction to Heat Transfer, by lncropera and Dewitt, Wiley Publishers,2001.
5. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.

Note: - Heat and mass transfer data book by C.P. kothandaraman, New age publications is permitted for internal and external examinations.

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0319	Thermal Engineering – II	3	0	0	3

Course Outcomes:

CO: 1 To understand efficiency enhancement methods of Reheating and regeneration. Student can able to understand the key role of quality of steam after evaporation
CO: 2 To able to understand the working of different high pressure and low-pressure boilers.
CO: 3 To able to distinguish the ideal flow and actual flow through nozzle. Student can know the importance of maximum discharge through nozzle.
CO: 4 To construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine.
CO: 5 To participate in science exhibitions based on the concept of thermal power plants.

UNIT I

BASIC CONCEPTS: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

UNIT II

BOILERS: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.

DRAUGHT: Classification – Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught

UNIT III

STEAM NOZZLES: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal and Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio. Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at The Exit. CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

UNIT IV

IMPULSE TURBINE:

Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed, Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine - Its Features. Methods To Reduce Rotor Speed - Velocity Compounding and Pressure Compounding, Velocity and Pressure Variation Along the Flow – Combined Velocity Diagram for a Velocity Compounded Impulse Turbine.

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REACTION TURBINE: Mechanical Details – Principle of Operation, Thermodynamic Analysis of a Stage, Degree of Reaction –Velocity Diagram – Parson's Reaction Turbine – Condition for Maximum Efficiency.

UNIT V

JET PROPULSION: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo Jet, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion

Text Books:

1. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013
2. Basic and Applied Thermodynamics, P.K. Nag, TMH, 2nd Edition,2012

Reference Books:

1. Gas Turbines, V. Ganesan, TMH
2. Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.
3. Thermal Engineering, Mahesh M Rathore, McGrawHill,2010
4. Gas Turbines and Propulsive Systems, P.Khajuria&S.P.Dubey, Dhanpatrai
5. Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand, 2012.
6. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.
7. Steam Tables SI Units- Dr.B. Umamaheswar Gowd and A. Nagraju, Siri Publ.

NOTE: *Steam tables and Mollier charts to be supplied for exam*

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0316	Management Science	3	0	0	3

Course Outcomes:

CO: 1 Understand the concepts & principles of management and designs of organization in a practical world.
CO: 2 Apply the knowledge of Work-study principles & Quality Control techniques in industry.
CO: 3 Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
CO: 4 Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
CO: 5 Create Modern technology in management science

UNIT I

Introduction to Management:

Management - Concept - Nature - Functions – Levels - Evolution of Management Thought - Taylor's Scientific Theory - Henry Fayol's principles - Elton Mayo's Human relations - Leadership styles - Autocratic leadership - Democratic & Free rein leadership.

Organizational Designs: Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization.

UNIT II

Operations Management:

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study. **Material Management** - Objectives – Inventory classification - Inventory Techniques - EOQ-ABC Analysis

Marketing Management: Concept - Meaning - Nature- Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

UNIT III

Human Resources Management (HRM):

HRM - Definition and Meaning - Managerial and Operative functions - Evolution of HRM - Job Analysis & Job Evaluation - Human Resource Planning (HRP) Process/Procedure- Employee Recruitment Process - Employee Selection Process and Tests in Employee Selection - Employee Training and Development - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT IV

Strategic Management:

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - 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).

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UNIT V

Contemporary Management:

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.

Textbooks:

1. A.R Aryasri, "Management Science", TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

References:

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.

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0317	Optimization Techniques	3	0	0	3

Course Outcomes:

CO: 1 Explain the need of optimization of engineering systems
CO: 2 Understand optimization of electrical and electronics engineering problems
CO: 3 Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
CO: 4 Apply unconstrained optimization and constrained non-linear programming and dynamic programming
CO: 5 Formulate optimization problems

UNIT I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II:

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT – III:

Unconstrained Nonlinear Programming: One dimensional minimization method, Classification, Fibonacci method and Quadratic interpolation method Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method.

UNIT – IV:

Constrained Nonlinear Programming: Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT – V:

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in

dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution

TEXT BOOKS:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

REFERENCE BOOKS:

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0318	Intriduction to CAD/CAM	3	0	0	3

Course Outcomes:

CO: 1 Understand the basic concepts components of CAD/CAM. Concepts of Graphics techniques.
CO: 2 Understand the concepts of Geometric representation methods..
CO: 3 Understand and apply Numerical CNC Part Programming methods.
CO: 4 Understand the concepts of Group technology and techniques, production flow Analysis.
CO: 5 Understand the concepts of FMS and its elements.

UNIT I

Introduction: Definition and scope of CAD/CAM- Computers in industrial manufacturing, design process-Computer Aided Design (CAD)-Computer Aided Manufacturing (CAM)-Computer Integrated Manufacturing (CIM)

Graphics: Data base for graphic modeling-transformation geometry-3D transformations – Clipping-hidden line removal-Colour-shading

UNIT II

Geometric modelling

Parametric representation of curves, solids & surfaces. Geometric construction methods-Constraint based modeling- Wireframe, Surface- Bezier , B-Spline Surfaces and Solid-Constructive Solid Geometry,Boundary representation and Cellular Decomposition.

UNIT III

NC Control production systems:

Introduction to NC, CNC, DNC - Manual part Programming – Computer Assisted Part Programming – Examples using NC codes- Adaptive Control – Canned cycles and subroutines – CAD/ CAM approach to NC part programming – APT language

UNIT IV

Role of information systems in manufacturing

Discrete part manufacture-information requirements of a production organization-manufacturing strategies-Integration requirement - Group technology-coding-Production flow analysis-computer part programming-CAPP implementation techniques.

UNIT V

Automated manufacturing systems

Flexible Manufacturing systems (FMS) – the FMS concepts – transfer systems – head changing FMS – Introduction to Rapid prototyping, Knowledge Based Engineering, Virtual Reality, Augmented Reality –automated guided vehicle-Robots-automated storage and retrieval systems - computer aided quality control-CMM-Non contact inspection methods.

Textbooks:

1. P.N.Rao, CAD/CAM: Principles &Applications-3rd Edition, Tata McGraw Hill.
2. CAD/CAM Concepts & applications/Alavala/PHI

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References:

1. CAD/CAM Theory and Practice / IbrahimZeid / TMH..
2. CAD/CAM/CIM Radha Krishnan & Subramanian / New age
3. Principles of computer Aided Design and Manufacturing / Fanlc / Amirouche / Pearson.
4. Computer Numerical Control Concepts and Programming / Warrens & Seames / Thomson

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0513	Machine Learning	3	0	0	3

Course Outcomes:

CO: 1 Understand the concepts of computational intelligence like machine learning
CO: 2 Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
CO: 3 Understand the Neural Networks and its usage in machine learning application
CO: 4
CO: 5

UNIT - I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT - II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT - III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT- IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

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Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First - Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT - V

Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXT BOOKS:

1. Machine Learning – Tom M. Mitchell - McGraw Hill Education, 2017

REFERENCES:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis Chapman and Hall/CRC; 2nd edition, 2014

2. Machine Learning For Beginners: A Comprehensive Guide To Understand Machine Learning. How It Works And How Is Correlated To Artificial Intelligence And Deep Learning, Chris Neil, Alicex Ltd, 2020

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0216	Neural Networks and Fuzzy Logic	3	0	0	3

Course Outcomes:

CO: 1 Understand the basic architecture of artificial neural network terminologies and techniques.
CO: 2 Understand approaches and architectures of Artificial Intelligence.
CO: 3 Perform the training of neural networks using various learning rules.
CO: 4 Create different neural networks of various architectures both feed forward and feed backward.
CO: 5 Application of ANN to System Identification and Pattern recognition.

UNIT – I ARTIFICIAL NEURAL NETWORKS

Approaches to AI – Architectures of AI – Symbolic Reasoning System – Rule based Systems – Knowledge Representation – Expert Systems. Introduction and motivation: Neural Network, Human Brain, Structure of biological neuron, Memory, Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies, Artificial Intelligence and Neural Networks.

UNIT – II

Learning Process: Layers, activation functions, learning methods: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Memory, Adaption, Back Propagation and Differentiation, Supervised Learning, unsupervised learning.

UNIT – III NETWORKS

Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories - Self-Organization Map – Hopfield models – ART networks.

UNIT – IV UNIT – IV FUZZYLOGC

Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT – V FUZZY LOGIC APPLICATIONS

Fuzzy pattern recognition – Fuzzy control system – Aircraft landing control problem Statistical process control- Fuzzy cognitive mapping – Probability measures – Possibility and necessity measures.

TEXT BOOKS:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Neural Networks using MATLAB”, McGraw Hill Edition, 2006.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Third Edition, WILEY India Edition, 2012.

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REFERENCES:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013.
2. Laurene V. Fausett "Fundamentals of Neural Networks: Architectures, Algorithms and Applications" United States Edition.
3. Yung C. Shin and Chengying Xu, "Intelligent System – Modeling, Optimization & Control, CRC Press, 2009

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1: Engineering knowledge	1.3	1.3.1
CO: 2	PO1: Engineering knowledge	1.3	1.3.1
CO: 3	PO2: Problem analysis	2.4	2.4.1
CO: 4	PO1: Engineering knowledge	1.3	1.3.1
		1.4	1.4.1
CO: 5	PO1: Engineering knowledge	1.3	1.3.1

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AOE0101	Structural Helath Monitoring	3	0	0	3

Course Outcomes:
CO: 1 Learn about failure and damage detection
CO: 2 Study the structural health monitoring in civil engineering structures
CO: 3 Know about Sensor technology in civil engineering
CO: 4 Study the IOT in SHM
CO: 5 Learn about Real time SHM application

UNIT I
INTRODUCTION: Failure of concrete, Deterioration of concrete, Repair techniques, NDT techniques, Structural health monitoring, Necessary of SHM.

UNIT II
STRUCTURAL HEALTH MONITORING: SHM techniques, SHM for construction materials, SHM for fresh concrete and harden concrete, SHM for Bridges

UNIT III
SENSORS in SHM: SHM monitoring parameters, Sensors and types of sensors in SHM, SHM working principal, Damage Identification and assessment

UNIT IV:
DATA PROCESSING: Data Acquistion System (DAS), IOT in SHM, AI in SHM, Energy harvesting technology in SHM, Static and Vibration based SHM

UNIT V
APPLICATION: Real time SHM application, Self-sensing concrete, Future of SHM

TEXT BOOKS:
1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Guemes, John Wiley and Sons, 2006
2. Health Monitoring of Structural Materials and Components Methods with Applications

REFERENCES:
1. Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components_Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AHE9902	Principles of Effective Public Speaking	3	0	0	3

Course Outcomes:

CO: 1 Gain and demonstrate the basic skills of effective oral communication, for use throughout your academic career and beyond.

CO: 2 Learn and develop the skills necessary to maximize public speaking effectiveness, including effective research and organization of information, how to make the most of presentation aids (and not become reliant on them!), and understanding the speaker-audience relationship.

CO: 3 Develop critical thinking and listening skills, enabling you to maximize your own understanding as an audience member, and offer considered and constructive critiques of others' speeches.

CO: 4 Become more confident in public speaking arenas, whether as a formal speech giver or as a participant in group settings. Improvement will be valued over perfection.

Unit -1

Introduction to Public Speaking:

Basic communication concepts, processes, and models Communication concepts and principles and public speaking Steps and methods of speech preparation; Ethics in public speaking

Unit -2

Listening and Speech Criticism:

Effective listening, the listening process, and types of listening; Listening barriers; Identifying and improving listening styles; Evaluating speech and effective speech techniques.

Unit -3

Selecting Topic and Knowing your Audience:

Identifying sources; Tools and techniques for selecting and refining speech topics; Identifying speech purposes; Central idea statement; The central idea; Audience analysis techniques.

Unit – 4

Speaking with a Purpose:

Informative, persuasive, and ceremonial speeches

Unit:5

Delivering your speech and using Visual Aids.

The mechanics of verbal and nonverbal communication in speech delivery; Modes of speech delivery; Speaking style and language; Effective delivery techniques; Incorporating presentation aids.

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References:

1. DeVito, J.A. (2009). The Essential Elements of Public Speaking. (3rd ed.) Boston: Pearson Education, Inc.
2. Lucas, S.E. (2009). The Art of Public Speaking. (10th ed.) New York: McGraw - Hill Co.
3. Zarefsky, D. (2011). Public Speaking: Strategies for Success. (6th ed. Boston: Pearson Education, Inc).

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO10: Communicate effectively on complex engineering	10.2	10.2.2
CO2	PO10: Communicate effectively on complex engineering.	10.2	10.2.1
CO3	PO9: Function effectively as an individual	9.2	9.2.1
CO4	PO10: Communicate effectively on complex engineering.	10.2	10.2.2
CO5	PO10: Communicate effectively on complex engineering.	10.3	10.3.1

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AHE9904	Advanced Numerical Methods	3	0	0	3

Course Outcomes:

CO: 1 Understand the Formulation Techniques for solving problems used in engineering problems.
CO: 2 Apply the Curve Fitting procedures and understand Regression concept.
CO: 3 Analyses the Iterative methods of solving problems in Partial differential equations.
CO: 4 Know and be able to apply the procedure of solving the solution of Parabolic Equations.
CO: 5 Develop to solve techniques for solving problems in Hyperbolic partial differential equations. using

Unit I: Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements, Variational methods- Raleigh Ritz method, Galerkin method.

Unit-II Curve fitting and approximation of functions: Least square approximation fitting of non-linear curves by least squares –regression analysis- multiple linear regression, non linear regression.

Unit III: Numerical solutions of partial differential equations: Introduction, classification of second order equations, finite difference approximation to derivatives, Iterative methods for Laplace's equation and Poisson `s equations.

Unit IV: Solution of Parabolic Equations: Bender –Schmidt Method-Bender – Schmidt Recurrence Equation, Crank-Nicholson Difference Method
Unit V: Solution of Hyperbolic partial differential equations: Solving wave equation by finite differences-stability of numerical method

Textbooks:

3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
4. Finite element methods by Chandraputla & Belagondu.
3."Numerical Methods for Engineers", Steven C.Chapra, Raymond P.Canale Tata Mc-Graw Hill

References:

1. Finite element procedures, . K. J. Bathe, Prentice -Hall, 1996
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

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List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO2: Analyse complex engineering problems	2.1	2.1.3
CO2	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO3	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO4	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO5	PO1: Apply the knowledge of mathematics	1.1	1.1.2

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AHE9908	Electromagnetic Theory	3	0	0	3

Course Outcomes:

CO: 1 Analyze electrostatics with their related theorems.
CO: 2 Illustrate electrostatics in matter by dielectrics and their properties.
CO: 3 Analyze Magnetostatics with mathematical proofs.
CO: 4 Analyze Maxwell's equations and Electromagnetic wave propagation.
CO: 5 Enumerate the applications of Electromagnetic wave propagation

UNIT I

Electrostatics

Introduction to Electrostatics – Gauss law – electrostatic potential – Poisson's and Laplace equations – Green's theorem – Green's functions (Basics only).

UNIT II

Electrostatics in Matter

lectrostatic field in matter – Dielectrics – Polarization – polarization vector – field outside polarized dielectric – bound charges – Electric displacement vector – Gauss law in presence of dielectrics – linear dielectrics –Boundary conditions in dielectric media.

UNIT III

Magnetostatics

Introduction to Magnetostatics – Conservation of charge and equation of continuity – Biot Savart's law – Magnetic field due to a localized current distribution – Ampere's law – Magnetic vector potential – magnetic scalar potential – magnetic moment, force and torque on a current distribution in an external field.

UNIT IV

Maxwell's Equations

Equation of continuity in electrodynamics – Faraday's law of induction – Maxwell's equations – Maxwell displacement current – Maxwell equations in differential and integral forms – Physical significance – Boundary conditions – Vector and scalar potentials - Gauge invariance –Coulomb and Lorentz gauges – Energy and momentum of the field – Introduction to four vectors- D' Alembertian Operator.

Unit 5: Wave Propagation

Propogation of electromagnetic waves in free space- Plane waves in a nonconducting media – Electromagnetic waves in conducting media – Reflection and refraction of EM waves at a plane interface and laws-Propagation of EM waves between parallel and perfectly conducting planes – Rectangular wave guide and circular wave guide-Basics of Antenna.

Text Books:

1. David. J.Griffiths – Introduction to Electrodynamics – Pearson Education; 4 edition (2015)
2. J.D.Jackson – Classical Electrodynamics – 3rd edition – John Wiley & Sons (2007)
3. B.B.Laud – Electromagnetics – New Age International Publisher; 3rd edition (2011)
4. Books Basic Electronic Engineering By B.L. Theraja

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Reference Books:

1. J.R.Reitz, F.J.Milford and R.W.Christy – Foundations of Electromagnetic theory – 3rd edition – Addison Wesley (1980)
2. Wolfgang K. H. Panofsky, Melba Phillips- Classical Electricity and Magnetism: 2nd Edition- Courier Corporation (2012)

Web References:

1. www.physics.uq.edu.au/people/ficek/pdfs/ph3050.pdf
2. http://en.wikipedia.org/wiki/Main_Page
3. http://www-math.mit.edu/~djk/18_022/chapter12/section03.html
4. http://enphy.zhetao.com/booksec.dep?op=list&v=vi&conId=12174213324521329
5. http://www.cramster.com/electromagnetic-theory-lecture-notes-r26-18-cpi0-1.aspx

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1 : Apply the knowledge of science	1.2	1.2.1
CO: 2	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 3	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 4	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 5	PO1: Apply the knowledge of science	1.2	1.2.1

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AMC9904	Professional Ethics and Human Values	3	0	0	3

Course Outcomes:

CO: 1 It ensures students sustained happiness through identifying the essentials of human values and skills.

CO: 2 The students will understand the importance of Values and Ethics in their personal lives and professional careers.

CO: 3 The students will learn the rights and responsibilities as an employee, team member and a global citizen.

CO: 4 Students understand practically the importance of trust, mutually satisfying human behavior and enriching interaction with nature. □

CO: 5 Students can able to develop appropriate technologies and management patterns to create harmony in professional and personal life

UNIT - I: **12hrs**

Introduction to Human Values: Need, basic Guidelines, Content and Process for Value Education, Self Exploration - 'Natural Acceptance' and Experiential Validation. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities. Understanding Happiness and Prosperity correctly.

UNIT - II: **12hrs**

Understanding Harmony in the Family and Society: Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family!

UNIT – III: **12hrs**

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – IV: **15hrs**

Professional Practices in Engineering: Work Place Rights & Responsibilities, Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers – The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

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UNIT – V: **12hrs**

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Depletion, Pollution, Ethics in Manufacturing and Marketing, Media Ethics, War Ethics, Bio Ethics, Intellectual Property Rights.

Text Books:

1.R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2.Professional Ethics: R. Subramanian, Oxford University Press, 2015. 3.Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

Reference Books:

1. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.
2. Ivan IIIich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
3. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S PritchaMichael J Rabins, 4e , Cengage learning, 2015.
4.Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO2	PO8:Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO3	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO4	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO5	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0318	Heat Transfer Lab	0	0	2	1

Course Outcomes:

CO: 1 Estimate heat transfer coefficients in forced and natural convection and determine the effectiveness of heat exchangers and heat pipe.
CO: 2 Perform the transient heat conduction experiment and obtain the variations of temperature along length of pin-fin.
CO: 3 To determine overall heat transfer coefficient for composite walls
CO: 4 Perform experiment to determine thermal conductivity of metal rod.
CO: 5 Perform radiations experiments and determine the surface emissivity and Stefan boltzman's constant and compare the theoretical values.

1. Heat transfer coefficient in forced convection.
2. Heat transfer coefficient in natural convection
3. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
4. Thermal conductivity of insulating material through lagged pipe apparatus
5. Overall heat transfer co-efficient through Composite Slab Apparatus
6. Thermal Conductivity of metal (conductor).
7. Heat transfer in pin-fin
8. Experiment on Transient Heat Conduction
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Experiment on Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Study of Two – Phase flow.

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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0320	Design & Simulation Lab	0	0	2	1

Course Outcomes:
CO: 1 Design of 2D models using software
CO: 2 Design of 3D models and analysis
CO: 3 Create simulation of any simple components
CO: 4 Design and simulation of machine components
CO: 5 Analysis of any components using software

List of experiments:

1. Any simple 2D drawing using CATIA. (4 Models)
2. 3D modelling using CATIA, Creo, Solidworks, etc., (4 Models)
3. Simulation of simple 3D models. (4 Models)