MECHANICAL ENGINEERING
COURSE STRUCTURE
B. Tech I SEMESTER

S.No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	18ME1T01	HSMC	English-1	2	-	-	2	2
2	18ME1T02	BSC	Linear Algebra & Differential Equations	3	1	-	4	4
3	18ME1T03	BSC	Engineering Chemistry	3	-	-	3	3
4	18ME1T04	ESC	Problem solving through C	3	-	-	3	3
5	18ME1T05	ESC	Engineering Mechanics	3	1	-	4	4
6	18ME1L06	HSMC	English Communication Skill Lab-1	-	-	2	2	1
7	18ME1L07	BSC	Engineering Chemistry Lab	-	-	3	3	1.5
8	18ME1L08	ESC	Problem solving through C Lab	-	-	3	3	1.5
9	18ME1T09	MC	Environmental Studies	2	-	-	2	-
						Total number of credits		**20**

B. Tech II SEMESTER

S.No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	18ME2T01	HSMC	English-II	1	0	**2**	3	2
2	18ME2T02	BSC	Vector Calculus and Fourier Transforms	3	0	-	3	3
3	18ME2T03	BSC	Engineering Physics	3	0	-	3	3
4	18ME2T04	BSC	Biology for Engineers	2	-	-	2	2
5	18ME2T05	ESC	Basic Electrical & Electronics Engineering	3	-	-	3	3
6	18ME2T06	ESC	Engineering Graphics	3	-	-	3	3
7	18ME2L07	BSC	Engineering Physics Lab	-	-	3	3	1.5
8	18ME2L08	ESC	Basic Electrical & Electronics Engineering Lab	-	-	2	2	1
9	18ME2L09	ESC	Basic Engineering & IT Workshop	-	-	3	3	1.5
						Total number of credits		**20**

B. Tech III SEMESTER

S.No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	18ME3T01	PCC	Complex variables & Numerical methods	2	1	0	3	3
2	18ME3T02	BSC	Mechanics of Solids	2	1	0	3	3
3	18ME3T03	PCC	Kinematics of Machines	2	1	0	3	3
4	18ME3T04	PCC	Thermodynamics	2	1	0	3	3
5	18ME3T05	ESC	Materials science and Engineering	3	0	0	3	3
6	18ME3T06	PCC	Fluid mechanics & hydraulic machines	3	0	0	3	3
7	18ME3L07	PCC	Fluid mechanics & Hydraulic machines lab	0	0	3	1.5	1.5
8	18ME3L08	PCC	Mechanics of Solids & Metallurgy LAB	0	0	3	1.5	1.5
9	18ME3L09	HSMC	Proficiency through Reading and Writing	0	0	2	2	1
						Total number of credits		22

B. Tech IV SEMESTER

S.No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	18ME4T01	BSC	Probability & Statistics	2	1	0	3	3
2	18ME4T02	ESC	Production Technology	3	0	0	3	3
3	18ME4T03	PCC	Design of Machine Elements	2	1	0	3	3
4	18ME4T04	ESC	IC Engines & Air Compressors	2	1	0	3	3
5	18ME4T05	PCC	Computer Aided Machine Drawing	1	0	4	3	3
6		OEC	**Open Elective-1**	3	0	0	3	3
7	18ME4L09	ESC	Production Technology Lab	0	0	3	3	1.5
8	18ME4L10	PCC	Thermal engineering Lab	0	0	3	3	1.5
9	18ME4T11	MC	Indian constitution	2	0	0	2	0
10	18ME4I12	P	Summer Internship	0	0	0	0	1
						Total number of credits		22

B. Tech V SEMESTER

S.No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	18ME5T01	PCC	Dynamics of Machines	2	1	0	3	3
2	18ME5T02	HSMC	Management Science & Productivity	3	0	0	3	3
3	18ME5T03	PCC	Turbo machines	3	0	0	3	3
4	18ME5T04	PCC	MC&MT	3	0	0	3	3
5		OEC	**Open Elective-2**	3	0	0	3	3
6	18ME5L13	PCC	Theory of machines Lab	0	0	3	1.5	1.5
7	18ME5L14	PCC	MT Lab	0	0	3	1.5	1.5
8	18ME5L15	HSMC	Communication Skills Lab	0	0	2	2	1
9	18ME5T16	MC	Essence of Indian Traditional Culture	2	0	0	0	0
				Total number of credits				19

B. Tech VI SEMESTER

S.No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	18ME6T01	PCC	Design of Transmission Elements	2	1	0	3	3
2	18ME6T02	PCC	Heat Transfer	2	1	0	3	3
3	18ME6T03	PCC	Metrology and measurements	3	0	3	3	3
4		PEC	**Professional Elective -1**	3	0	0	3	3
	18ME6T04		Experimental Stress Analysis					
	18ME6T05		Design for Manufacturing					
	18ME6T06		R & AC					
5		OEC	**Open Elective-3**	3	0	0	3	3
6	18ME6L21	PCC	Metrology & Instrumentation Lab	0	0	3	3	1.5
7	18ME6L22	PCC	Heat Transfer Lab	0	0	3	3	1.5
8	18ME6T23	MC	Disaster Management	2	0	0	2	0
9	18ME6I24	P	Summer Internship	-	-	-	-	1
				Total number of credits				19

B. Tech VII SEMESTER

S.No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	18ME7T01	PCC	CAD CAM	3	0	0	3	3
2	18ME7T02	HSMC	Operational Research	3	0	0	3	3
3		PEC	**Professional Elective -2**	3	0	0	3	3
	18ME7T03		Finite Element Methods					
	18ME7T04		Gas Dynamics & Jet Propulsion					
	18ME7T05		Production Planning & Control					
4		PEC	**Professional Elective -3**	3	0	0	3	3
	18ME7T06		Advanced Materials					
	18ME7T07		Power plant Engineering					
	18ME7T08		Optimization Techniques through MATLAB					
5		PEC	**Professional Elective -4**	3	0	0	3	3
	18ME7T09		Condition Monitoring and Signal Conditioning					
	18ME7T10		Computational Fluid Dynamics					
	18ME7T11		Advanced Machining Processes					
6	18ME7L12	PCC	CAD CAM Lab	-	-	4	2	2
7	18ME7P13	P	Mini project	-	-	4	2	2
			Total number of credits					19

B. Tech VIII SEMESTER

S.No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1		PEC	**Professional Elective -5**	3	0	0	3	3
	18ME8T01		Mechanical Vibrations					
	18ME8T02		Automobile Engineering					
	18ME8T03		Non Destructive Evaluation					
2		OEC	**Open Elective-4**	3	0	0	3	3
3		OEC	**Open Elective-5**	3	0	0	3	3
4	18ME8S19	P	MOOCS	-	-	4	4	2
5	18ME8P20	P	Project	-	-	16	16	8
			Total number of credits					19

OPEN ELECTIVES
Open elective-1 (IV Semester)

S.No.	Course Code	Course Category	Course Title	Offering Dept.
1.	18ME4T06	OEC	Engineering Economics & Financial Analysis	DMS
2.	18ME4T07	OEC	Management Information System	CSE
3.	18ME4T08	OEC	Entrepreneurship & Project Management	DMS

Open elective-2 (V Semester)

S.No.	Course Code	Course Category	Course Title	Offering Dept.
1.	18ME5T05	OEC	Employability Skills: Quantitative Aptitude & Reasoning	BED
2.	18ME5T06	OEC	Optimization Techniques	BED
3.	18ME5T07	OEC	Electrical Engineering Materials	EEE
4.	18ME5T08	OEC	Basics of Control Systems	EEE
5.	18ME5T09	OEC	Design Thinking & Product Innovation	ME
6.	18ME5T10	OEC	Solid State Devices and Circuits	ECE
7.	18ME5T11	OEC	Principles of Communication	ECE
8.	18ME5T12	OEC	Employability Skills: Competitive Coding	CSE/IT

Open elective-3 (VI Semester)

S.No.	Course Code	Course Category	Course Title	Offering Dept.
1.	18ME6T07	OEC	Employability Skills: Quantitative Aptitude & Reasoning	BED
2.	18ME6T08	OEC	Basic Civil Engineering	CE
3.	18ME6T09	OEC	Sustainable Engineering Practices	CE
4.	18ME6T10	OEC	Disaster Management	CE
5.	18ME6T11	OEC	Low Cost Housing	CE
6.	18ME6T12	OEC	Design and Estimation of Electrical Systems	EEE
7.	18ME6T13	OEC	Energy Audit, Conservation and Management	EEE
8.	18ME6T14	OEC	Nanotechnology	ME
9.	18ME6T15	OEC	Microprocessors and microcontroller	ECE
10.	18ME6T16	OEC	Embedded Systems	ECE
11.	18ME6T17	OEC	Employability Skills: Competitive Coding	CSE/IT
12.	18ME6T18	OEC	Computer Networks	CSE/IT
13.	18ME6T19	OEC	Managerial Economics and Financial Analysis	DMS
14.	18ME6T20	OEC	Cross Cultural management	DMS

Open elective-4 (VIII Semester)

S.No.	Course Code	Course Category	Course Title	Offering Dept.
1.	18ME8T04	OCE	Robotics	ME
2.	18ME8T05	OCE	Additive manufacturing	ME
3.	18ME8T06	OCE	Green Engineering Systems	ME
4.	18ME8T07	OCE	Polymer Chemistry	BED
5.	18ME8T08	OCE	Advanced Civil Engineering Technologies	CE
6.	18ME8T09	OCE	Advanced Drawing for Civil Engineers	CE
7.	18ME8T10	OCE	Utilization of Electrical Energy	EEE
8.	18ME8T11	OCE	Power Quality	EEE

Open elective-5 (VIII Semester)

S.No.	Course Code	Course Category	Course Title	Offering Dept.
1.	18ME8T12	OCE	Mechatronics	ME
2.	18ME8T13	OCE	Micro-Electro- Mechanical Systems	ME
3.	18ME8T14	OCE	Solar Energy Systems	ME
4.	18ME8T15	OCE	Soft Computing Techniques	ECE
5.	18ME8T16	OCE	Satellite communication	ECE
6.	18ME8T17	OCE	Internet of Things	CSE
7.	18ME8T18	OCE	Operating Systems	CSE

Note: Prior approval from the department is required for the selection of open electives

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I

SEMESTER

SYLLABUS

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I Semester	L	T	P	C
	2	0	0	2

ENGLISH-1 (18ME1T01)

Syllabus:

Unit 1   Human Resources

              Ideal Family

Unit 2   In London

              Verger

Unit 3   Our Living

              Environment Three

              Days to See

Unit 4   Part A: Energy: Alternative

              Sources War

Unit 5   Principles of Good

              Writing Letter Writing

References:

1. English for Engineers and Technologists, Orient Blackswan

2. Prose for Communication, Ravindra Publishing House

3. Panorama, Oxford University Press

I Semester   L   T   P   C

                                                       3   1   0   4

LINEAR ALGEBRA & DIFFERENTIAL EQUATIONS (18ME1T02)

UNIT I: Linear systems of equations, Eigen values & Eigen vectors

Rank of a matrix, Echelon form, Normal form, PAQ is in normal form, linear dependence and independence, Consistency of linear system of equations, System of linear homogeneous equations. Gauss -Jordan method, LU decomposition method, **Application:** Finding the current in electrical circuits, Eigen values, Eigen vectors, Properties of Eigen values (without proofs).

UNIT II: Quadratic forms & Differential calculus:

Cayley-Hamilton theorem (without proof), Reduction to diagonal form, Reduction of quadratic form to canonical form, Nature of quadratic form. Limits and continuity and differentiability, Mean value theorems, Taylor's and Maclaurin's series. Functions of two variables, Partial derivatives, Homogeneous functions, Total derivative, Jacobian, Taylor's theorem for functions of two variables. **Applications:** Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT III: Differential equations of first order:

Formation of a differential equation, Solution of a differential equation, Variables separable method, Linear equations, Bernoulli's equation, Exact differential equations. Equations reducible to exact equations, **Applications:** Orthogonal Trajectories, Newton's Law of cooling, Rate of decay & growth.

UNIT IV: Differential equations higher order:

Part –A : Definitions, Complete solution, Operator D, Rules to find Complementary function, Inverse operator, Rules to find the particular integral(RHS term of the type e^{ax} , Sin(ax+b), cos(ax+b), polynomials in x). Rules to find the particular integral (RHS term of the type e^{ax} V(x), any other function), Method of variation of parameters. **Application:** L-C-R circuits.

UNIT V: Laplace Transforms (all properties without proofs):

 Definition, Transforms of elementary functions, properties of Laplace transforms, Transforms of periodic functions, Transforms of derivatives and integrals, Multiplication by t^n, Division by t. Inverse Laplace transforms–Method of partial fractions, other methods of finding inverse transforms, Convolution theorem (without proof). **Application**: Application to differential equations.

Text Books:

1. **B. S. GREWAL,** Higher Engineering Mathematics, Khanna Publishers**,** 43rdEdition, 2014.

2. **B. V. RAMANA,** Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007.

Reference Books:

1. **N. P. BALI & Dr. MANISH GOYAL,** A Text book of Engineering Mathematics,

Lakshmi Publications, 9th Edition, 2014.

2. **ERWIN KREYSZIG,** Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.

I Semester	L	T	P	C
	3	0	0	3

ENGINEERING CHEMISTRY (18ME1T03)

UNIT I: POLYMERS AND PLASTICS

Introduction- Degree of polymerization-functionality- tactility -stereospecific

polymers   Types- Addition polymerization-Definition-PVC-Properties-applications

Condensation polymerization-Bakelite-Properties-applications-differences between addition and condensation polymerization-Physical and mechanical properties of polymers-Thermoplastics and Thermosetting plastics. Conducting polymers– Biodegradable polymers-applications– Natural rubber-Disadvantages - Compounding of rubber - vulcanization – Synthetic rubber: Thiokol- Composite materials & Fiber reinforced plastics

UNIT II: BASICS OF ELECTRO CHEMISTRY AND CORROSION

PART-A Galvanic cell - Electro chemical series - Standard electrodes (Hydrogen and Calomel electrodes)Primary cells: Zinc – air cell Secondary cells:- Lithium ion batteries, Pb-acid cell,

Fuel cells:- H2-O2 fuel cell and molten carbonate fuel cells

Corrosion:- Dry Corrosion– Wet (Electrochemical) Corrosion –Factors influencing the rate of corrosion – Protection from corrosion – Cathodic protection – Electro plating -Electroless plating

UNIT III : WATER TECHNOLOGY

Hard water:- Reasons for hardness – units of hardness

Boiler troubles – Priming and Foaming, Sludge and Scale formation, Boiler corrosion, Caustic embrittlement. Softening of water : Zeolite process- Ion Exchange process

Effluent treatment (biological, aerobic and anaerobic methods)

Water for drinking purposes- Purification – Sterilization and disinfection: Chlorination, Break point chlorination. Desalination of brackish water– Reverse Osmosis and Electro Dialysis

UNIT IV: FUELS

Fuels:- Introduction – Classification – Characteristics of a good fuel-Calorific value - HCV and LCV – Dulong's formula – Bomb calorimeter – Numerical problems

Solid fuels —Coal — Proximate and ultimate analysis –Significance of the analyses

Liquid fuels – Petroleum- Refining – Cracking – Synthetic petrol –Petrol knocking – Diesel knocking - Octane and Cetane ratings – Anti-knock agents –Power alcohol – Bio-diesel

Gaseous fuels – Natural gas – LPG and CNG

UNIT V: CHEMISTRY OF MATERIALS AND ANALYTICAL TECHNIQUES

Lubricants: - Definition, function, Theory and mechanism of lubricants, properties (Definition and

importance)-viscosity, flash and fire point, aniline point, cloud and pour point

Nano materials:-Introduction –General methods of preparation (top down and bottom up) - Applications

Green synthesis:- Introduction- Principles - methods of synthesis– alternative reactive media (aqueous phase method) and alternative energy sources(microwave method) -R4M4 principles- Econoburette.

UV Spectroscopy- Basic principle-Instrumentation- Applications

IR Spectroscopy- Basic principle-Instrumentation- Applications

NMR Spectroscopy- Basic principle-Instrumentation-

Applications Analytical techniques: FE-SEM,TEM,BET

Chromatography techniques: Paper chromatography, Thin layer chromatography- applications

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co.

2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).

2. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.

3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition

4. Applied Chemistry by H.D. Gesser, Springer Publishers

5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM

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I Semester	L	T	P	C
	3	0	0	3

PROBLEM SOLVING THROUGH C (18ME1T04)

UNIT I

INTRODUCTION TO COMPUTERS

Functional Components of computer, computer software, categories of memory, types of programming languages, Development of algorithms, flow charts, software development process.

BASICS OF C PROGRAMMING:

Introduction to programming paradigms, Structure of C program, Data Types, C Tokens, Operators: Precedence and Associativity, Expressions Input/output statements, Assignment statements

UNIT II

Decision making statements: if, if else, nester if. Muti way decision making statements: else if, Switch statement

Looping statements: while, do while, for, Compilation process

UNIT III

 Introduction to Arrays: Declaration, Initialization, One dimensional array, Example Programs on one dimensional array, Selection sort, linear and binary search, Two dimensional arrays, Matrix Operations, Multi dimensional Arrays

Strings: Declaration, String operations: length, compare, concatenate, copy, String handling functions.

UNIT IV

FUNCTIONS

 Introduction to functions: Function prototype, function definition, function call, Built-in functions, Recursion , Storage classes, Passing Arrays & Strings to the functions, Preprocessor directives

POINTERS

Pointers, Pointer operators, Pointer arithmetic, Arrays and pointers, Array of pointers, Parameter passing: Pass by value, Pass by reference, Dynamic Memory Allocation.

UNIT V

STRUCTURES AND UNIONS

Structure , Nested structures , Pointer and Structures , Array of structures , Example Program using structures and pointers , Self referential structures, Unions.

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FILE PROCESSING

Files, Types of file processing: Sequential access, Random access, Sequential access file, Random access file, Command line arguments

Text Books:

1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Krnighan. B.W and Ritche, D.M, "The C Programming Language", Second Edition, Pearson Education, 2006
3. Pradep dey, Manas Ghosh, "Fundamentals of Computing and programming in C", First Edition, Oxford University Press, 2009.

References:

1. Paul Deitel and Harvey Deitel, "C How to Program", Seventh Edition, Pearson Publication.
2. E Balagursamy, "Programming in C, Sixth Edition, Tata McGraw Hill.
3. Ajay Mittal, "Programming in C A practical Approach", Pearson education

I Semester	L	T	P	C
	3	1	0	4

ENGINEERING MECHANICS (18ME1T05)

UNIT – I: Introduction to Engg. Mechanics – Basic Concepts.

Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

UNIT – II

Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction, Wedges.

Analysis of plane trusses-Method of Joints, Method of Sections.

UNIT – III

Centroid: Centroid of simple figures (from basic principles) – Centroid of Composite Figures.

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappu's theorems.

UNIT IV

Area moment of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation– Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

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TEXT BOOKS :

1. Engineering Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.

2. Engineering Mechanics- S S Bhavikati –New Age International Publishers

REFERENCES :

1. Engineering Mechanics, statics and dynamics – I.H.Shames, – Pearson Publ.

2. Engineering Mechanics, Fedinand . L. Singer, Harper – Collins.

3. Engineering Mechanics statics and dynamics , A Nelson , Mc Graw Hill publications

4. Engineering Mechanics- A K Tayal

5. Engieering Mechanics , R.K.Bansal, Laxmi Publications

6. Engg. Mechanics- KL Kumar-Tata McGraw Hill publications

I Semester	L	T	P	C
	0	0	2	1

ENGLISH COMMUNICATION SKILLS LAB-1
(18ME1L06)

List of Experiments:

1   Greetings and Introduction

2   Request Permission & Giving Directions

3   Inviting/Complaining/Congratulating

4   Root Words

5   Phonetics-Sounds and Symbols

6   Pronunciation Rules

References:

1. *Strengthen Your Steps*, Maruti Publications

2. *Interact*, Orient Blackswan

3. *Word Power Made Easy*, Pocket Books

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I Semester

	L	T	P	C
	0	0	3	1.5

ENGINEERING CHEMISTRY LABORATORY (18ME1L07)

S.No	Name of the Experiment
1	Introduction to chemistry laboratory
2	Determination of HCl using standard Na_2CO_3 solutions
3	Determination of alkalinity of a sample containing Na2CO3 and NaOH.
4	Determination of temporary and permanent hardness of water using standard EDTA solution.
5	Determination of Copper using standard EDTA solution
6	Determination of ferrous iron using standard $K_2Cr_2O_7$ solution
7	Determination of $KMnO_4$ using standard Oxalic acid solution
8	Determination of pH of the given sample solution using pH meter
9	Conductometric Titrations between strong acid and strong base
10	Potentiometric Titrations between strong acid and strong base
11	Synthesis of Phenol-Formaldehyde resin
12	Synthesis of Urea-Formaldehyde resin
13	Determination of Surface tension of a liquid
14	Determination of Viscosity of a liquid
15	Determination of Flash and Fire point of a lubricant
16	Determination of Cloud and Pour point of a lubricant
17	Determination of Aniline point of a lubricant

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I Semester   **L   T   P   C**

                                                          0   0   3   1.5

PROBLEM SOLVING THROUGH C LAB (18ME1L08)

1.   Write a C program to convert temperature from Fahrenheit to Celsius.

     Write a C program to find the roots of a quadratic equation.

     Write a program to implement simple calculator using switch case

2.   Write a C program to determine if the given number is a prime number or not.

     Write a program to display the factorial of a given number

3.   Write a program to display whether a given is Armstrong or not

     Write a C program to generate the first n terms of the Fibonacci sequence.

4.   Write a C program to display the reverse of a given number.

     Write a C program to calculate the following sin and cos value

5.   Write a program for sorting numbers in a list.

6.   Write programs for searching a number in the list using

     a.Linear search

     b.Binary search

7.   Write programs that reads two matrices to perform the following:

     a.Addition of two matrices

     b.Multiplication of two matrices

8.   Write a program to perform the following operations without using build in string operations:

     a.To display the length of the string.

     b.To check whether the string is palindrome or not

     c.To delete n characters from a given position in a given string.

9.   Write a program to generate GCD of two numbers using functions

10. Write a C program that reads two integers n and r to compute the ncr value using the following

     relation: ncr(n, r) = n! / r! (n,r)! . Use a function for computing the factorial value of an integer.

11. Write programs for the following using recursive functions

     a.Factorial of a given number

     b.GCD of two numbers

     c. Fibonacci series

12. Write a program to demonstrate call by value and call by reference.

13. Write a program to perform following operating using pointers

     a.Reverse of a string

     b.Comparison of two strings

14. Write a program for displaying the details of the student by sorting them according to the marks

     using structure containing roll no, name and marks.

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15. Write a program for merging two files

16. Write a program to count no of lines, words, characters in a file
17. C Program to Create Employee File Name Record that is taken from the Command Line
   Argument

I Semester	**L**	**T**	**P**	**C**
	2	**0**	**0**	**0**

ENVIRONMENTAL STUDIES (18ME1T09)

UNIT-I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Introduction- Scope of Environmental Studies- Importance of Environmental Studies- Need for public awareness, Environmental ethics- Contemporary Environmentalists- Environmental Global moves: Stockholm conference, Earth summit.

Concept of an ecosystem - Structure of an ecosystem- function of an ecosystem- Food chains, food webs- ecological pyramids- Energy flow in the ecosystem- Ecological succession- Nutrient cycling- 1^oproduction& 2^oproduction- Major ecosystems: Forest ecosystem- Grassland ecosystem, Desert ecosystem- Aquatic ecosystem: pond, Lake Ecosystem- Streams, river ecosystem, Oceans.

UNIT-II: NATURAL RESOURCES AND CONSERVATION

Introduction and classification of natural resources- Forest resources**:** Use and over-exploitation
- Deforestation-Timber extraction-Mining- Conservation- Water resources**:** Use and over utilization of surface and ground water,- Floods, drought, Dams and associated problems- Water conservation, rain water harvesting, water shed management- Energy resources**:** renewable energy sources –solar- wind- hydro-tidal- Ocean thermal-geo thermal-bio mass-bio gas-bio fuels- Hydrogen.- Non-renewable energy sources-coal-petroleum-natural gas-Nuclear energy

UNIT-III: BIODIVERSITY AND ITS CONSERVATION

Definition, classification- Value of biodiversity- Threats to biodiversity: habitat loss, man-wildlife conflicts- Endangered and endemic species of India- Conservation of biodiversity- Biodiversity at national and local levels, Hot-sports of biodiversity

UNIT-IV: ENVIRONMENTAL PROBLEMS

Global warming,Climate change- Acid rain , Ozone depletion- Air pollution- Water pollution- Soil pollution- Noise pollution, Nuclear hazards- Solid Waste Management: Causes, Consequences and Control methods- Solid Waste Management- Population growth and explosion, effects,control measures- Pollution case studies- Role of an individual in prevention of pollution

UNIT-V: ENVIRONMENTAL LEGISLATION &MANAGEMENT

Sustainable development- Air (Prevention and Control of Pollution) Act-Drawbacks- Water (Prevention and control of Pollution) Act- Drawbacks- Wildlife Protection Act- Drawbacks- Forest Conservation Act- Drawbacks- Environmental Protection Act- Drawbacks- Environmental Impact Assessment and its significance- Preparation of Envirronmental Management Plan and Environmental Impact Statement- Ecotourism

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TEXT BOOKS:

1. Environmental Studies, Anubha Kaushik, C P Kaushik, New Age Publications, New Delhi

2. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada

3. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.

4.Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson

Education, Chennai

REFERENCE:

1. Text Book of Environmental Studies, Deeshita Dave & P. UdayaBhaskar, Cengage Learning.

2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi

3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi

4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Delhi

II

SEMESTER

SYLLABUS

II Semester   **L   T   P   C**

                                                   1   0   2   2

ENGLISH-II (18ME2T01)

Unit 1: Transport: Problems and

   Solutions The Scarecrow

Unit 2: The Drunkard

   A Village Lost to the Nation **Unit**

3: Evaluating Technology

   The Knowledge Society

Unit 4: Industry: Safety and Training

   Martin Luther King and

   Africa

Unit 5: Man's Peril (Detailed)

   Report Writing

References:

1. English for Engineers and Technologists, Orient Blackswan

2. Prose for Communication, Ravindra Publishing House

3. Panorama, Oxford University Press

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ENGLISH COMMUNICATION SKILLS LAB II

1   a.   Introducing Yourself and Other People

          Employability Skills

      b.   Introduction to Soft Skills

          My Skills, My Strengths

2   a.   Discussing Daily Routines

          Free Time Activities

      b.   Describing Family

          Talking about Family

3   a.   Giving Directions

          Ordering Food

      b.   Asking for and Paying the Bill

          Describing Appearances and Personality

4   a.   Writing a Product Description-1

      b.   Writing a Product Description-2

5   a.   Describing an Advertised Job

          Skills Needed for Different Jobs

      b.   What Kind of Job Are You Interested in?

          Finding out about a Job

6.   a.   Managing Nerves in a Presentation

      b.   Learning about Presentations

Reference:

Online Resources:

https://goo.gl/v57WHe

http://www.careerbuilder.co.in

https://goo.gl/w3FweC

https://goo.gl/4GoueJ

II Semester

L	T	P	C
3	0	0	3

VECTOR CALCULUS AND FOURIER TRANSFORMS (18ME2T02)

UNIT I: SPECIAL FUNCTIONS & MULTIPLE INTEGRALS:

Special functions: Beta function, Properties & problems, Gamma function, properties & problems, Relation between Beta and Gamma functions, Evaluation of improper integrals.

Multiple Integrals: Double integrals in Cartesian & polar coordinates, Change of order of integration, Triple integrals, Change of variables (Cartesian to Polar, Cartesian to Cylindrical & Cartesian to Spherical polar coordinate systems).

Applications: Area enclosed by plane curves, Volume of solids.

UNIT II: VECTOR CALCULUS:

Vector Differentiation: Introduction, Scalar and Vector point functions, Del applied to scalar point functions-Gradient, Del applied to vector point functions-Div& Curl, Del applied twice to point functions, Del applied to products of point functions (Identities without proofs).

Vector Integration: Line integral, Green's theorem in the plane (without proof), Surface integrals, Stokes theorem (without proof), Volume integral, Gauss Divergence theorem (without proof).

UNIT III: FOURIER SERIES:

Euler's formulae (without proof), Conditions of a Fourier expansion, Functions having points of discontinuity. Change of interval, Even and odd functions, Half-range series.

UNIT IV: FOURIER TRANSFORMS:

Fourier Integral, Fourier cosine & sine integral, complex forms of Fourier integral. Fourier transform, Fourier sine & cosine transforms, properties of Fourier transforms (without proof), Convolution theorem(without proof), finite Fourier sine & cosine transforms.

UNIT V: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS:

Definition of PDE, Classification of 2nd order PDE, Variable separable method, Vibrations of a stretched string – Wave equation. One-dimensional heat flow, Two-dimensional heat flow, Solution of Laplace's equation.

Text Books:

1. B. S. GREWAL, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014.

2. B. V. RAMANA, Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007.

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Reference Books:

1. N. P. BALI & Dr. MANISH GOYAL, A Text book of Engineering Mathematics,

Lakshmi Publications, 9th Edition, 2014.

2. ERWIN KREYSZIG, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.

II Semester

	L	T	P	C
	3	0	0	3

ENGINEERING PHYSICS (18ME2T03)

UNIT –I

CRYSTAL STRUCTURE

Lattice, Basis and Unit cell – Lattice parameters – Bravais Lattices – Crystal Systems – Coordination number –SC, BCC, FCC – Packing Fraction. Miller Indices – Crystal Planes – Inter planar distance – X- ray Diffraction – Bragg's Law- Imperfections in Crystals – Point defects

UNIT –II

WAVES & OSCILLATIONS

Characteristics of sound waves – Simple harmonic motion-Displacement-Amplitude-Time period – Frequency-Phase-Wavelength-Equation for SHM. Free Vibrations-Damped vibrations- Forced vibrations –Resonance.

UNIT– III

ACOUSTICS

Reverberation time -Sound Absorption, Absorption Coefficients and its measurement – Sabine's Formula – Basic Requirements of Acoustically good hall – Factors affecting architectural Acoustics and their remedies.

ULTRASONICS

Production – Ultrasonic transducers – Non Destructive Testing(NDT) – Pulse Echo Technique - Different types of Scans – Applications.

UNIT–IV

INTRODUCTION TO ELECTROMAGNETIC THEORY

Grad – Div – Curl – Gauss and Stoke's theorems – Fundamental Laws of Electromagnetism.
Maxwell's Equations – Poynting vector- Propagation of Electromagnetic waves in a dielectric medium.

UNIT – V

LASERS

Characteristics of Lasers – Spontaneous and Stimulated Emission – Population Inversion - Einstein Coefficients – Ruby Laser – He-Ne Laser – Applications.

OPTICAL FIBERS

Principle of Optical fiber – construction – Acceptance angle – Numerical Aperture – Types of Optical fibers – Single and Multi mode, Step Index and Graded Index fibers — Engineering Applications(Buildings , Bridges, Pavements and Sensors).

Text Books:

1. Engineering Physics by R.K.Gaur and S.L.Gupta – Dhanpatrai Publications
2. Engineering Physics by M.Avadhanuluand P.G. Kshirasagar – S Chand Publications (10th Edition)

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3. Applied Physics by S.O.Pillai – New Age Publications – (3rd Edition)

4. Introduction to Solid State Physics by Charles Kittel, Wiley India Pvt Ltd.

Reference Books:

1. Engineering Physics by P.K.Palanisamy – Scitech Publications (2014 Edition)

2. Engineering Physics by M.Armugam – Anuradha Publications

3. Engineering Physics by M.R.Srinivasan (2014 Edition) New Age International Publications.

4. Engineering Physics by V.Rajendran (2010 Edition) Mc Graw Hill Publications.

II Semester	L	T	P	C
	2	0	0	2

BIOLOGY FOR ENGINEERS (18ME2T04)

UNIT-1: INTRODUCTION

Importance and need of biology- Discoveries of biology in 18th Century: Brownian motion and the origin of thermodynamics- their importance in any scientific inquiry. Classification of organisms based on (a) Cellularity- Unicellular or Multicellular , (b) Ultra structure- prokaryotes or eucaryotes. (c) Energy and carbon utilization -autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitat- acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life.

UNIT-2: BIOMOLECULES

Introduction to molecules of life-monomeric units and polymeric structures of carbohydrates, Sugars, starch and cellulose, amino acids and proteins structure and function. Nucleotides and DNA/RNA, Hierarchy of DNA Structure- from single stranded to double helix, two carbon units and lipids.

UNIT-3: ENZYMES & METABOLISM

Enzyme classification, mechanism of enzyme action, enzyme kinetics and kinetic parameters. Thermodynamics as applied to biological systems, endergonic and exergoinc reactions, Concept of kinetic equilibrium and its relation to standard free energy Spontaneity, ATP as an energy currency, Glycolysis, Krebs cycle and Energy yielding and energy consuming reactions.

UNIT-4: INFORMATION TRANSFER

Concept of genetic code. Molecular basis of information transfer; Transcription and translation.

UNIT-5: MICROBIOLOGY

Concept of species and strains, Identification of Microorganisms. Sterilization and media compositions, Growth kinetics.

TEXT/REFERENCE BOOKS:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

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II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

BASIC ELECTRICAL & ELECTRONICS ENGINEERING (18ME2T05)

UNIT – I: ELECTRIC CIRCUITS

Basic definitions, Types of network elements & sources, Ohms law, Kirchhoff's laws, Series & parallel circuits. Source transformation, Network reduction reductions, Introduction to AC circuits.

UNIT – II: ELECTRICAL MACHINES

Basic laws – Faraday's laws of electromagnetic induction, Lenz's law, Right hand thumb rule, Fleming's left hand and right hand rules, Construction, working principle and applications of DC machines**.** Construction, working principle and applications of transformers, induction motor and synchronous machines.

UNIT – III: ELECTRICAL POWER GENERATION, TRANSMISSION AND DISTRIBUTION

Sources of Energy – conventional & non conventional, Introduction and layout of thermal, hydel power plants**.** Introduction and layout of nuclear power plants, solar power plants, Concepts of power transmission and distribution using single line diagram.

UNIT – IV: ELECTRICAL INSTALLATIONS & SAFETY

Components of Switchgear – fuse, MCBs, types of wires & cables, earthing, different types of batteries, Elementary calculations for energy consumption and types of tariffs. Energy Conservation. Electric shock and first aid, Hazardous areas, General principles of electric safety.

UNIT – V: BASIC ELECTRONIC DEVICES AND THEIR APPLICATIONS

Introduction to semi-conductor physics, PN junction diode, Zener diode, Transistor - operation, characteristics and configurations, Operation of transistor as a switch. Half wave, full wave and bridge rectifier using diodes, types of filters, Zener diode as a voltage regulator, transistor as an amplifier. introduction to feedback amplifiers.

TEXT BOOKS:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

3. Electronic Devices and Circuits – Salivahanan, Kumar, Vallavaraj, TATA McGraw Hill, Second Edition

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II Semester	L	T	P	C
	3	0	0	3

ENGINEERING GRAPHICS (18ME2T06)

UNIT I:

Lettering, Dimensioning, Geometrical Constructions. Polygons: General construction method, Inscribing and describing methods. Cycloids: Cycloid, Epicycloid, Hypocycloid and Involutes- Tangent and Normals to the above curves.

UNIT II :

Orthographic projections: Introduction, Projections of points. Projections of straight lines- parallel to both the planes, parallel to one plane and inclined to the other plane. Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclinations and traces.

UNIT III

Projections of planes: Regular planes perpendicular/parallel to one plane and inclined to the other reference plane, Projections of planes inclined to both the reference planes.

UNIT IV:

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the reference planes.

Sections of solids: Prisms, Pyramids, Cones and Cylinders in simple positions.

UNIT V:

Isometric Projections: Isometric views/projections of planes and simple solids, Conversion of orthographic views to isometric views. Conversion of isometric views to orthographic views. Introduction to AutoCAD

Text Books:

1. Engineering Drawing, N. D. Butt, Chariot Publications
2. Engineering Drawing +Auto CAD, K Venugopal &V Prabhuraja, Newage Publishers.

Reference Books:

1. Engineering Drawing, K. L. Narayana & P. Kannaiah, Scitech Publishers.
2. Engineering Graphics for Degree, K. C. John, PHI Publishers
3. Engineering Drawing, Agarwal & Agarwal, Tata McGraw Hill Publishers
4. Engineering Graphics, P.I. Varghese, McGraw Hill Publishers

II Semester

L	T	P	C
0	0	3	1.5

ENGINEERING PHYSICS LAB (18ME2L07)

(Any 10 of the following listed experiments)

LIST OF EXPERIMENTS:

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.

2. Newton's rings – Radius of Curvature of Plano - Convex Lens.

3. Determination of thickness of a spacer using wedge film and parallel interference fringes.

4. Determination of wavelength of laser source using diffraction grating.

5. Determination of Numerical Aperture and bending loss of a given optical fiber.

6. Determination of Rigidity modulus of a material- Torsional Pendulum.

7. Determination of Acceleration due to Gravity and Radius of Gyration- Compound Pendulum.

8. Verification of laws of vibrations in stretched strings - Sonometer

9. Determination of Young's modulus by method of single cantilever oscillations.

10. Melde's experiment – Transverse and Longitudinal modes.

11. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.

12. L- C- R Series Resonance Circuit.

13. Study of I/V Characteristics of Semiconductor diode.

14. I/V characteristics of Zener diode.

15. Energy Band gap of a Semiconductor p - n junction.

II Semester	L	T	P	C
	0	0	2	1

BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (18ME2L08)

LIST OF EXPERIMENTS

1. Study of different switches, MCBs, measuring instruments, wires and cables.

2. Identification and measurement of resistance, inductance & capacitance.

3. Practice house wiring with MCB, 3 pin socket, 2 way control of lamp.

4. Load test on DC shunt motor

5. Load test on DC shunt Generator

6. Constructional study of machine and engine parts using their cut sections.

7. Identification and testing of different electronic devices like diode, BJT, FET, SCR, IGBT, MOSFET, UJT etc.,

8. Practice soldering with simple electronic components on PCB.

9. V-I Characteristics of PN junction diode

10. Characteristics of Bipolar Junction Transistor

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II Semester

	L	T	P	C
	0	0	3	1.5

BASIC ENGINEERING & IT WORKSHOP
(18ME2L09)

Engineering Workshop

1. Carpentry

    1. T-Lap Joint

    2. Cross Lap Joint

    3. Dovetail Joint

    4. Mortise and Tenon Joint

2. Fitting

    1. Vee Fit

    2. Square Fit

    3. Half Round Fit

    4. Dovetail Fit

3. Black Smithy

    1. Round rod to Square

    2. S-Hook

    3. Round Rod to Flat Ring

    4. Round Rod to Square headed bolt

4. Tin Smithy

    1. Taper Tray

    2. Square Box without lid

    3. Open Scoop 4. Funnel

IT Workshop

1. Identification of computer peripherals, installation of OS and troubleshooting.

2. Orientation and practice on MS Word.

3. Orientation and practice on MS Excel.

4. Orientation and practice on MS Power Point.

5. LAN & Wi-Fi Network connectivity using TCP/IP settings and customization of web browsers.

6. Introduction to HTML and design of basic web page.

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III

SEMESTER

SYLLABUS

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III Semester   **L   T   P   C**

                                                                    3   0   0   3

COMPLEX VARIABLES & NUMERICAL METHODS (CVNM) (18ME3T01)
(Common to EEE & ME)

UNIT-I: Analytic Functions

Introduction, Complex function, Limit and continuity of a complex function, Derivative of f(z), Analytic functions, Harmonic functions & orthogonal system, Milne-Thomson method.

Applications: Applications to flow problems.

UNIT-II: Integration and Series Expansions

Complex integration, Cauchy's theorem and Cauchy's integral formula (without proofs), Series of complex terms, Taylor's series and Laurent's series (without proofs).

UNIT-III: Integration using Residues

Zeros & singularities of an analytic function, Residues, Residue theorem (without proof), Calculation of residues. Evaluation of integrals of the type (a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$

(b) $\int_{c}^{c+2\pi} f(\cos\Box,\sin\Box)d\Box$ $\int_{-\infty}^{\infty} e^{imx} f(x)dx$ (d) Integrals by indentation

UNIT IV: Numerical Solution of Equations:

Solution of Algebraic and transcendental equations: Bisection method, Method of false position and Newton-Raphson method (one variable and non-linear simultaneous equations).

Iterative methods of solution of linear simultaneous equations: Jacobi's and Gauss-Seidel iteration methods.

UNIT V: Numerical Integration & Numerical Solution of ODE:

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd and 3/8th rules.

Numerical Solution of ODE: Picard's method, Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta method of 4th order.

Text Books:

3. **B. S. GREWAL,** Higher Engineering Mathematics, Khanna Publishers**,** 43rdEdition, 2014.

4. **B. V. RAMANA,** Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007.

Reference Books:

3. **N. P. BALI & Dr. MANISH GOYAL,** A Text book of Engineering Mathematics,

Lakshmi Publications, 9th Edition, 2014.

4. **ERWIN KREYSZIG,** Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.

III Semester

	L	T	P	C
	2	1	0	3

MECHANICS OF SOLIDS (18ME3T02)

UNIT – I

SIMPLE STRESSES &STRAINS : Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress-strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain, Relation between elastic constants – Bars of varying section – composite bars – Temperature stresses- Compound Stresses - Principal planes and principal stresses - Mohr's circle -, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams and loads – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

FLEXURAL STRESSES: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$, Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT –IV

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. Statically Indeterminate Beams and solution methods.

TORSION: Introduction-Derivation of torsion equation- Torsion of Circular shafts- Pure Shear- Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT – V

THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of

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thin cylinders – Riveted boiler shells – Thin spherical shells.

THICK CYLINDERS: –lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.

Text Books:

1. GH Ryder, Strength of materials, 3/e, Mc Millan publishers IndiaLtd, 1983.
2. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.
3. Timoshenko, Strength of Materials Part-I& II, 3/e, CBS Publishers, 2004.

References:

1. U.C Jindal, Strength of Materials, Pearson Education, 2012.
2. Junnarkar S. B, Mechanics of Structures, Vol-III Charotar, 1974.
3. SS Rattan, Strength of materials, 3/e, Tata McGraw-Hill, 2016.
4. Andrew Pytel, Ferdinand Leon Singer, Strength of Materials, 4/e, Harper & Row, 2007.

III Semester	L	T	P	C
	2	1	0	3

KINEMATICS OF MACHINES (18ME3T03)

UNIT – I

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

Grublers criterion, Grashoff's law , Degrees of freedom, Kutzbach criterion for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains.

UNIT – II

LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russel – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph.

Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio; Hooke's Joint: Single and double – Universal coupling–application–problems.

UNIT – III

KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.

Plane motion of body: Instantaneous centre of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV

CAMS

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

in the above 3 cases. Analysis of motion of followers: Roller follower – circular cam with straight, concave and convex flanks.

Power Transmissions : Introduction, Belt and rope drives, selection of belt drive- types of belt drives, V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

UNIT – V
GEARS

Higher pairs, friction wheels and toothed gears–types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

GEAR TRAINS: Introduction to gear Trains, Train value, Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains. Selection of gear box-Differential gear for an automobile.

TEXT BOOKS:
1. Theory of Mechanisms and machines, A.Ghosh & A.K.Malik , 4/e,East West Press Pvt. Ltd,2011
2. Theory of Machines, S.S.Rattan ,4/e, Tata Mc-Graw Hill, 2014
3. Theory of machines and Mechanisms – J.J Uicker, G.R.Pennock & J.E.Shigley, 3/e Oxford publishers,2009.

REFERENCES:
1. Theory of Machines and Mechanisms, J.E.Shigley ,4/e, Oxford, 2014
2. Theory of Machines & Mechanisms, P.L.Ballaney, 25/e, Khanna Publishers, Delhi, 2003
3. Mechanism and Machine Theory by Ashok G. Ambekar, 1/e PHI Publishers,2007.
4. The Theory of Machines, by Bevan (Author), 3/e Paperback,2009
5. Kinematics of Machinery through Hyper Works,J.S. Rao,18 volume,Springer Publ,2001
6. Theory of machines and Machinery,Vickers,4/e, Oxford 2014

III Semester

L	T	P	C
2	1	0	3

THERMODYNAMICS (18ME3T04)

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.

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**.**

UNIT II

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

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 V

AIR STANDARD CYCLES: Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Comparison of Otto, Diesel and dual cycles

Refrigeration cycle: Rankine cycle, Brayton cycle.

TEXT BOOK(S)

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.

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REFERENCES

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.

III Semester

L	T	P	C
3	0	0	3

MATERIALS SCIENCE AND ENGINEERING
(18ME3T05)

UNIT – I

STRUCTURE OF METALS AND CONSTITUTION OF ALLOYS: Bonds in Solids, Crystal structure of metals, grains and grain boundaries, determination of grain size and effect of grain size on the mechanical properties of metal / alloys. Necessity of alloying, types of solid solutions, Hume Rothery's rules.

UNIT –II

EQUILIBRIUM DIAGRAMS: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, eutectic systems, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Pb-Sn, $Fe-Fe_3C$, Cu-Ni and Al-Cu.

UNIT –III

CAST IRONS AND STEELS: Extraction of Iron, Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, applications of cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, Maraging steels, tool and die steels.

UNIT – IV

HEAT TREATMENT OF ALLOYS: Effect of alloying elements on $Fe-Fe_3C$ system, Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – V

NON-FERROUS METALS AND ALLOYS: Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

CERAMIC AND COMPOSITE MATERIALS: Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterials – definition, properties and applications. Classification of composites, various methods of component manufacture of composites, particle reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal matrix composites and C – C composites.

PLASTICS: Introduction to plastics and polymers, Types of plastics and Composites based on plastics.

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Text Books:

1. Essential of Materials science and engineering - Donald R. Askeland and Wendelin J. Wright,

   Global Engineering Publisher, 4th edition, 2019.

2. Introduction to Physical Metallurgy - Sidney H. Avener, McGrawHill Publishers, 2nd edition and 2017.

References:

1. Material Science and Metallurgy – Dr. V.D.Kodgire, Everest Publishers, 31st edition and 2011.

2. Materials Science and engineering - Callister & Balasubramanian, Wiley Publications, 9th edition and 2015.

3. Material Science for Engineering students – Traugott Fischer – Elsevier Publisher and 2009.

4. Material science and Engineering - V. Rahghavan, PHI Publisher, 6th edition, and 2015.

5. Introduction to Material Science and Engineering – Yip-Wah Chung, CRC Press 1st edition and 2006

6. Material Science and Metallurgy – A V K Suryanarayana, B S Publications 1st edition and 2014.

7. Material Science and Metallurgy – U. C. Jindal – Pearson Publications, 1st edition and 2011.

8. Physical Metallurgy- Vijendra Singh- Standard Publishers, 1st edition, and 2005.

III Semester

	L	T	P	C
	3	0	0	3

FLUID MECHANICS & HYDRAULIC MACHINES
(18ME3T06)

UNIT-I

Fluid statics: definition of fluid, continuum, dimensions and units, properties of fluids – specific gravity, viscosity and its significance, compressibility, surface tension, capillarity, vapor pressure and manometry, Pascal's law, hydrostatic law.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

Fluid kinematics: Methods of Analysis- System and control volume, Classification of flows-steady and unsteady, uniform and non-uniform, laminar and turbulent, rotational and irrotational, viscous and inviscid, internal and external flows, Continuity equation. Kinematics-stream tube, stream function, circulation and vorticity, stream function and potential function, condition for irrotational flow.

UNIT-II

Fluid dynamics: Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications- force on pipe bend, Measurement of flow - Venturimeter, Orificemeter and pitot tube, stagnation properties.

Closed conduit flow: Reynolds's experiment – Darcy-Weisbach equation – minor losses in pipes – pipes in series and pipes in parallel – total energy line – hydraulic gradient line.

UNIT-III

Boundary Layer Theory: concept of boundary layer, displacement, momentum and energy thickness, separation of boundary layer, measures of controlling boundary layer thickness.

Dimensional Analysis: Fundamental and derived dimensions, Rayleigh method, Buckingham theorem, dimensionless groups, application of dimensional groups, model testing and similitude, types of similarity- geometric, kinematic and dynamic.

UNIT-IV

Impact of Jets: Impulse momentum equation, Hydrodynamic force of jet striking stationary and moving-vanes, flat and curved vanes, centrally and tangentially, series of vanes, radial vanes, velocity triangles, work done and efficiency

Hydraulic Turbines: Classification of hydraulic turbines- Impulse and Reaction turbines, Pelton, Francis and Kaplan turbines, working principles, draft tube– theory and its functions, Unit and

specific quantities, performance curves.

UNIT-V

Rotodynamic Pumps: Classification – mixed, axial, construction, principle and application.

Centrifugal pumps- Classification, working principle, work done by impeller, specific speed, performance characteristic curves, cavitation & NPSH.

Positive displacement Pumps: Working - gear pump, vane pump, rotary piston pump,

Reciprocating pump - Working, Slip, Indicator diagrams, Air vessels.

TEXT BOOKS

1 Hydraulics & Fluid Mechanics Including Hydraulics Machines, Dr. P.N. Modi & Dr. S.M. Seth,RajsonsPubl, 21st Ed.,2017.

2 Fluid Mechanics and Hydraulic Machines, R. K. Bansal, Laxmi Publ.,10th Ed., 2018.

REFERENCES BOOKS

1 Fluid Mechanics and Hydraulic Machines, R.K. Rajput, S. Chand Publ., 6thEd., 2015.

2 Fluid Mechanics and Machinery, D. Ramadurgaiah, New-age International, 1st Ed., 2002.

3 Fluid Mechanics & Hydraulic Machines, T.R. Banga& S.C. Sharma, Khanna Publ.,16th Ed., 2016.

4 Fluid Mechanics and Hydraulic Machines,V.M. Domkundwar&A.V. Domkundwar, Dhanpat Rai & Co. 2014.

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III Semester

L	T	P	C
0	0	3	1.5

FLUID MECHANICS & HYDRAULIC MACHINES LAB (18ME3L07)

1. Experimental Verification of Bernoulli's Theorem.
2. Calibration of Venturimeter.
3. Calibration of Orifice meter.
4. Determination of friction factor for a given pipe line.
5. Determination of loss of head due to sudden contraction in a pipeline.
6. Turbine flow meter.
7. Impact of jets on Vanes.
8. Performance Test on Pelton Wheel.
9. Performance Test on Francis Turbine.
10. Performance Test on Single Stage Centrifugal Pump.
11. Performance Test on Multi Stage Centrifugal Pump.
12. Performance Test on Reciprocating Pump.

	L	T	P	C
III Semester	**0**	**0**	**3**	**1.5**

MECHANICS OF SOLIDS & METALLURGY LAB
(18ME3L08)

NOTE: Any 6 experiments from each section A and B.

(A) MECHNICS OF SOLIDS LAB:

1. Direct tension test

2. Bending test on

   a) Simple supported beam

   b) Cantilever beam

3. Torsion test

4. Hardness tests

   a) Brinells hardness test

   b) Rockwell hardness test

5. Test on springs

6. Compression test on cube

7. Impact test

8. Punch shear test

(B) METALLURGY LAB:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.

2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.

3. Study of the Micro Structures of Cast Irons.

4. Study of the Micro Structures of Non-Ferrous alloys.

5. Study of the Micro structures of Heat treated steels.

6. Hardenability of steels by Jominy End Quench Test.

7. To find out the hardness of various treated and untreated steels.

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III Semester	L	T	P	C
	0	0	2	1

PROFICIENCY THROUGH READING AND WRITING (18ME3L09)

Unit I   Vocabulary Building

1.1   The concept of word formation

1.2.   Root words from foreign languages and their use in English

1.3   Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4   Synonyms, antonyms, and standard abbreviations

Unit II Writing Skills

2.1   Organizing principles of paragraphs in documents

2.2   Creative writing

2.3   Essay writing

Unit III Identifying Common Errors in Writing

3.1   Subject-verb agreement

3.2   Noun-pronoun agreement

3.3   Misplaced modifiers

3.4   Articles

3.5   Prepositions

3.6   Redundancies

3.7   Clichés

Unit IV Comprehension

4.1   Scanning

4.2   Skimming

4.3   Identifying the main ideas

Unit V Reading for Pleasure

5.1   Review of an autobiography/biography

5.2   Review of a novel

5.3   Review of a self help book

Suggested Readings:

1.   Practical English Usage. Michael Swan. OUP. 1995.

2.   Remedial English Grammar. F.T. Wood. Macmillan.2007.

3.   On Writing Well. William Zinsser. Harper Resource Book. 2001.

4.   Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

5.   Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

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IV

SEMESTER

SYLLABUS

IV Semester	L	T	P	C
	2	1	0	3

PROBABILITY & STATISTICS (P & S) (18ME4T01)

UNIT I: Discrete Random variables and Distributions:

Introduction-Random variables- Discrete Random variable-Distribution function- Expectation- Moment Generating function-Moments and properties. Discrete distributions: Binomial and Poisson distributions.

UNIT II: Continuous Random variable and distributions:

Introduction-Continuous Random variable-Distribution function- Expectation-Moment Generating function-Moments and properties.

Continuous distribution: Normal distributions, Normal approximation to Binomial distribution.

UNIT III: Sampling Theory:

Introduction - Population and samples- Sampling distribution of means (s known)-Central limit theorem- t-distribution- Sampling distribution of means (s unknown)- Sampling distribution of variances -χ^2 and F-distributions- Point estimation- Maximum error of estimate - Interval estimation.

UNIT IV: Tests of Hypothesis:

Introduction –Hypothesis-Null and Alternative Hypothesis- Type I and Type II errors –Level of significance - One tail and two-tail tests- Tests concerning one mean and proportion, two means- Proportions and their differences- ANOVA for one-way and two-way classified data.

UNIT V: Curve fitting and Correlation:

Introduction - Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares-Goodness of fit. Correlation and Regression – Properties.

Text Books:

1. Richards A Johnson, Irvin Miller and Johnson E Freund. Probability and Statistics for Engineering, 9th Edition, PHI.

2. Jay l.devore, Probability and Statistics for Engineering and the Sciences, 8th edition, Cengage.

Reference Books:

1. ShronL.Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.

2. William Menden Hall, Robert J. Bever and Barbara Bever, Introduction to probability and statistics, Cengage learning, 2009.

IV Semester

	L	T	P	C
	3	0	0	3

PRODUCTION TECHNOLOGY (18ME4T02)

UNIT – I

CASTING: Steps involved in making a casting. Patterns – Types of patterns – Materials used for patterns, pattern allowances, Gating ratio and design of Gating systems. Risers – Types, function and design, casting design considerations. Gases in metals.

Solidifications. General defects in castings. Basic principles and applications of Centrifugal casting Die casting and Investment casting-advantages, disadvantages and applications.

UNIT – II

WELDING: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, Manual metal arc welding, Submerged arc welding, Inert Gas welding- TIG & MIG welding- advantages, disadvantages and applications.

UNIT – III

ADVANCED WELDING PROCESSES: Resistance welding, Solid state welding processes- Friction welding, Forge welding, Explosive welding; Thermit welding, Plasma welding, Laser welding, electron beam welding, Soldering & Brazing.

Heat affected zones in welding; Welding defects – causes and remedies – destructive and non-destructive testing of welds, Design of welded joints.

UNIT – IV

PLASTIC DEFORMATION: Hot working and Cold working, Strain hardening and Annealing. Bulk forming processes: Forging - Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing. Introduction to powder metallurgy – compaction and sintering, advantages and applications.

UNIT – V

SHEET METAL FORMING: - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools. High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electrohydraulic forming, rubber pad forming, advantages and limitations. Processing of Plastics: Types of Plastics, Properties, Applications and their processing methods, Blow and Injection moulding.

Text Books:

1. Manufacturing Technology -Vol I- P.N. Rao, 1st edition, Tata McGraw Hill Education and 2013

2. Fundamentals of Modern Manufacturing Materials, Processes, and Systems by Mikell P. Groover. John Wiley publications, 4th edition and 2010.

References:

1. Manufacturing Science – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd, 2nd edition and 2010.

2. Process and materials of manufacture- Allyn and Bacon, PHI publisher, 4th Edition, 1990.

3. Production Technology- R.K. Jain, Khanna Publisher 1st edition and 2015.

4. Production Technology-P C Sharma-S. Chand, 1st edition and 2006.

5. Manufacturing Processes- H.S. Shaun- Pearson publication, 1st edition and 2012.

6. Manufacturing Processes- J.P. Kaushish- PHI publication, 1st edition and 2010.

IV Semester

L	T	P	C
2	1	0	3

DESIGN OF MACHINE ELEMENTS (18ME4T03)

Unit I

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials, preferred numbers.

Design for Static Loads: Modes of failure, Factor of safety, design of components subjected to axial, bending, torsional and impact loads. Design for Theories of failure for static loads.

Unit II

Design for Dynamic Loads: Stress concentration, Types of fluctuating stresses, Endurance limit, Notch sensitivity, fatigue strength under axial, bending and torsion, fatigue design for infinite life. Fatigue theories of failure, Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

Unit III

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, eccentrically loaded bolted joints, gasketed joints.

Riveted Joints: Design of lap, butt and eccentrically loaded joints, failure and efficiency of riveted joints.

Welded Joints: Strength of lap and butt welds, eccentrically loaded welded joints. Joints subjected to bending and torsion.

Unit IV

Design of Cotters and Knuckle Joints: cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints-knuckle joints.

Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors. Shaft design on torsional rigidity basis.

Unit V

Keys: Function, types, design of sunk, saddle, Kennedy and Woodruff keys.

Couplings: Design of rigid, flange and bushed pin couplings, universal coupling.

Springs: Design of helical compression, tension, torsion springs. Design against fluctuating loads, concentric springs and leaf springs.

Text Book(s)

1. V.B.Bhandari, Design of Machine Elements, Tata McGraw Hill, 3/e, 2010.
2. J.E. Shigley, Mechanical Engineering Design, Tata McGraw Hill, 2/e, 1986.

References

1. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004.
2. R.K. Jain, Machine Design, Khanna Publications, 1978.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.

Note: Design data book is permitted.

IV Semester

L	T	P	C
2	1	0	3

I.C.ENGINES & AIR COMPRESSORS (18ME4T04)

UNIT – I

I.B. Engines: Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of Wankle engine, Principles of supercharging and turbo charging.

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT – II

Combustion in S.I. Engines: Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Types of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, antiknock additives – combustion chamber – requirements, types.

Combustion in C.I. Engines: Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – III

Measurement, 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 – IV

Compressors: Classification – positive displacement and roto dynamic machinery – Power producing and power is absorbing machines, fan, blower and compressor.

Reciprocating Compressor: Principle of operation, work required Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, under cooling, minimum work condition for two stage compression.

UNIT V

Rotary (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – Mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Slip factor, power input factor, pressure coefficient and adiabatic coefficient.

Axial Flow Compressors: Mechanical details and principle of operation and degree of reaction, work done factor - isentropic efficiency– Polytropic efficiency.

Text Books:

1   Internal Combustion Engines, V. Ganesan, Tata McGraw Hill, 4th Ed., 2017.
2   Internal Combustion Engine Fundamentals,John B. Heywood**,**McGraw-Hill, 2nd Ed., 2018.

References:
1   Thermal Engineering, R.K. Rajput, Lakshmi Publications, 8th Ed., 2010
2   Internal Combustion Engines, M.L. Mathur & R.P. Sharma, Dhanpath Rai & Sons Publications.
3   Thermal Engineering, R.S. Khurmi& J.S. Gupta, S.Chand Publications, 15th Ed., 2015

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IV Semester	L	T	P	C
	1	0	4	3

COMPUTER AIDED MACHINE DRAWING
(18ME4T05)

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

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.

The following contents to be done by any 3D CAD software
package Sectional views

Creating solid models of complex machine parts and create sectional views.

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, excentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling,

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

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. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.

4. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014

IV Semester	L	T	P	C
	3	0	0	3

ENGINEERING ECONOMICS & FINANCIAL ANALYSIS (18ME4T06)
(Open Elective-I)

UNIT-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics – Nature and Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting..

UNIT – II

Production and Cost Analyses:

Concept of Production function- Cobb-Douglas Production function- Law of One and Two Variable proportions- choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: Opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(simple problems)- Managerial significance and limitations of Breakeven point.

UNIT – III

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, and Internet Pricing: Flat Rate Pricing, Usage sensitive pricing and Priority Pricing.

UNIT – IV

Types of Business Organization, Business Cycles & Accounting Analysis:

Features and Evaluation of Sole Trader, Partnership, Joint Stock Company — Business Cycles: Meaning and Features – Phases of Business Cycle.

Introduction to Accounting & Financing Analysis:

Book-Keeping and Accounting – Financial Accounting – Concepts and Conventions – Double Entry System – Preparation of Journal, Ledger and Trial Balance – Preparation of Final Accounts – Trading, Profit and Loss Account and Balance Sheet With Adjustment Entries, Simple Problems Only

UNIT – V

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

TEXT BOOKS

1. Dr. N. AppaRao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V.Prabhakararao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

REFERENCES:

1. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House, 2014.
2. V. Maheswari: Managerial Economics, Sultan Chand.2014
3. Suma Damodaran: Managerial Economics, Oxford 2011.
4. VanithaAgarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson.
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui& A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
8. Ramesh Singh, Indian Economy, 7th Edn., TMH2015
9. Pankaj Tandon A Text Book of Microeconomic Theory, Sage Publishers, 2015
10. Shailaja Gajjala and Usha Munipalle, Univerties press, 2015

IV Semestr	L	T	P	C
	3	0	0	3

MANAGEMENT INFORMATION SYSTEM (18ME4T07)
(Open Elective-I)

UNIT - I:

Introduction : MIS importance, definition, nature and scope of MIS, Structure and Classification of MIS, Information and Systems Concept, Types of Information, Information systems for competitive advantage.

UNIT - II:

Business Applications of Information Systems: E-Commerce, ERP Systems, DSS, Business Intelligence, and Knowledge Management System.

UNIT- III:

Management of IS: Information system planning, system acquisition, systems implementation, evaluation & maintenance of IS, IS Security and Control.

UNIT - IV:

Building of Information Systems: System Development Stages, System Development Approaches, Systems Analysis and Design- Requirement Determination, Strategies for Requirement Determination, Structured Analysis Tools, System Design – Design Objectives, Conceptual Design, Design Methods, Detailed system design.

UNIT - V:

Introduction to Cyber Crime: Cyber space; cyber law; e-business; e - consumers; spam; phishing. Cybercrime and information security, cyber criminals , Classification of cyber criminals - Indian Perspectives - Cyber crimes and Indian IT Act 2000, Global perspective on cybercrime - Cybercrime era.

Text Books:

1. Management Information Systems, Laudon & Laudon, Pearson, 2015.
2. Management Information Systems–Managerial Perspective, D P Goyal, MacMillan, 3e Edition, 2010.

References:

3. Management Information Systems Text and Cases, Jawadekar, Tata Mc Graw Hill, 2012.

4. Management Information Systems, Kelkar, Prentice Hall India, 2012.

5. Cyber Security, Nina Godbole & Sunit Belapure, Wiley India, 2012.

IV Semester	L	T	P	C
	3	0	0	3

ENTREPRENEURSHIP & PROJECT MANAGEMENT (18ME4T08)

(Open Elective-I)

UNIT I

Meaning of Entrepreneurship - characteristics, functions and types of entrepreneurship - Intrapreneur - Role of entrepreneurship in economic development- Startups and Entrepreneurs – Key Elements of Entrepreneurial Ecosystem – Opportunities and Challenges – Changing Business Landscape in India during 2000-2015- – corporate entrepreneurship – mobility of entrepreneur – entrepreneurial motivation

UNIT II

Women Entrepreneurship: Role & Importance, Problems of Women Entrepreneurs-– Entrepreneurial Motivation, Performance and Reward – Government Policy & Regulations- Incentives and Subsidies – Support Entrepreneurship through Entrepreneurship Hubs (E- Hubs) – Listing Rules for Startups.

UNIT III

Project Management: Meaning of project - concepts - categories - project life cycle, phases - characteristics of a project – project manager - role and responsibilities of project manager.

UNIT IV

Project identification - selection - project formulation – contents of a project report - planning commission guidelines for formulating a project - specimen of a project report.

UNIT V

Source of finance for a project - Institutional finance supporting projects project evaluation - objectives - types - methods.

Relevant cases have to be discussed in each unit.

TEXT BOOKS

1. Ram Chandran, 'Entrepreneurial Development', Tata McGraw Hill, New Delhi
2. Saini, J. S., 'Entrepreneurial Development Programmes and Practices, Deep & Deep Publications (P), Ltd.

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REFERENCE

1. Khanka, S S. 'Entrepreneurial Development', S Chand & Company Ltd. New Delhi

2. Badhai, B 'Entrepreneurship for Engineers', Dhanpat Rai & co. (p) Ltd.

3. Desai, Vasant, 'Project Management and Entrepreneurship', Himalayan Publishing House, Mumbai, 2002.

4. Gupta and Srinivasan, 'Entrepreneurial Development', S Chand & Sons, New Delhi.

IV Semester

L	T	P	C
0	0	3	1.5

PRODUCTION TECHNOLOGY LAB (18ME4L09)

Minimum of 12 Exercises need to be performed

I. METAL CASTING:

1. Pattern Design and making - for one casting drawing.

2. Sand properties testing - for strength and permeability.

3. Mould preparation, Melting and Casting.

II WELDING:

1. Gas welding

2. Gas cutting

3. Manual metal arc welding - Lap & Butt Joints

4. TIG/MIG Welding

5. Resistance Spot Welding

6. Brazing and soldering

III METAL FORMING:

1. Blanking & Piercing operations.

2. Perform V-bending operation using hydraulic press.

IV PROCESSING OF PLASTICS

1. Injection Moulding

2. Blow Moulding

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IV Semester

L	T	P	C
0	0	3	1.5

THERMAL ENGINEERING LAB (18ME4L10)

1. I.C. Engines valve / Port timing diagrams.

2. I.C. Engines performance test and Exhaust emission measurements (4 -stroke diesel engine).

3. I.C. Engines performance test and Exhaust emission measurements (2-stroke petrol engine).

4. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.

5. Determination of FP by retardation and motoring test on IC engine.

6. I.C. Engines heat balance at different loads and show the heat distribution curve.

7. Performance test on variable compression ratio engines.

8. Performance test on reciprocating air compressor unit.

9. Performance Test on Refrigeration Tutor.

10. Economical speed test of an IC engine.

11. Disassembly/assembly of Engines.

12. Study of boilers, mountings and accessories.

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IV Semester

L	T	P	C
2	0	0	0

INDIAN CONSTITUTION (18ME4T11)

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

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

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy
- (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT-V

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

REFERENCES:

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1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi

2. Subash Kashyap, Indian Constitution, National Book Trust

3. J.A. Siwach, Dynamics of Indian Government & Politics

4. D.C. Gupta, Indian Government and Politics

5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

6. J.C. Johari, Indian Government and Politics Hans

E-RESOURCES:

1. nptel.ac.in/courses/109104074/8

2. nptel.ac.in/courses/109104045/

3. nptel.ac.in/courses/101104065/

4. www.hss.iitb.ac.in/en/lecture-details

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IV Semester

L	T	P	C
0	0	0	1

SUMMER INTERNSHIP (18ME4I12)

V

SEMESTER

SYLLABUS

V Semester　　　　　　　　　　　　　　**L**　　**T**　　**P**　　**C**

　　　　　　　　　　　　　　　　　　　　　2　　**1**　　**0**　　**3**

DYNAMICS OF MACHINERY (18ME5T01)

UNIT – I

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms, (Demonstration of models in video show).

CLUTCHES: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch

UNIT – II

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission.

GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. sensitiveness, isochronism and hunting.

UNIT – III

TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism**,** inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

UNIT – IV

BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples – examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT – V

VIBRATIONS: Free Vibration of spring mass system –Natural frequency-types of damping – damped free vibration, Simple problems on forced damped vibration, vibration isolation and transmissibility transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods,

Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

Text Books :

1. Theory of Machines / S.S Rattan/ Mc. Graw Hill

2. Mechanism and machine theory /Ashok G. Ambedkar/PHI Publications.

References :

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age

2. Theory of Machines / Shigley / MGH

3. Theory of Machines / Thomas Bevan / CBS Publishers

4. Theory of machines / Khurmi/S.Chand.

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V Semester

	L	T	P	C
	3	0	0	3

MANAGEMENT SCIENCE & PRODUCTIVITY (18ME5T02)

Unit 1

INTRODUCTION: Definition of Industrial Engineering (IE) - Development, Applications, Role of an industrial engineer, Differences between production management and industrial engineering, Quantitative tools of IE and productivity measurement. Concepts of management, importance, functions of management. Scientific Management – Taylor's principles. Theory X and Theory Y. Fayol's principles of management.

Unit 2

PLANT LAYOUT: Factors governing plant location, types of production layout, Advantages and disadvantages of product layout and process layout. Applications, Quantitative techniques for optimal design of layouts, Plant maintenance, Preventive and breakdown maintenance.

Unit 3

OPERATIONS MANAGEMENT: Importance, Types of production, Applications, Work study, Method study and Time study, Work sampling, PMTS, micro-motion study, rating techniques, MTM, Work factor system, Principles of Ergonomics, Flow process charts, string diagrams and Therbligs.

Unit 4

STATISTICAL QUALITY CONTROL: Quality Control, its importance, SQC, Sampling, Inspection, Types. Control charts, X bar and R charts, X bar and S charts and their applications. Numerical examples.

TOTAL QUALITY MANAGEMENT: Zero-defect concept, Quality circles, Implementation, Applications, ISO quality systems, Six sigma – definition, basic concepts.

Unit 5

RESOURCE MANAGEMENT: Concept of Human Resource Management (HRM), Personnel Management and Industrial Relations, functions of personnel management, Job evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, types.

VALUE ANALYSIS: Value Engineering, implementation procedure, Enterprise Resource Planning (ERP), Supply Chain Management (SCM). PERT and CPM, differences and applications, Critical path, determination of floats, importance, project crashing, smoothing and numerical examples.

Books:

   (1) Industrial Engineering and Management by O.P.Khanna, Khanna Publishers.

   (2) Industrial engineering and Production Management by Martand Telsang S.Chand & Company Ltd.,, New Delhi.

Reference Books:

(1) Operations Management **by** J.G.Monks, Mc Graw Hill Publishers.

(2) Industrial Engineering by Banga and Sharma.

(3) Principles of Management by Koonz and O'Donell, Mc Graw Hill Publishers.

(4) Statistical Quality Control by Gupta.

(5) Industrial Engineering and Management by Raju, Cengage Publishers.

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	L	**T**	**P**	**C**
V Semester	**3**	**0**	**0**	**3**

TURBOMACHINES (18ME5T03)

UNIT – I

Basic Concepts: Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating. Combustion: fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, Stoichiometry, flue gas analysis.

UNIT – II

Boilers: Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories-working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – draught, classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

UNIT – III

Steam Nozzles: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis-assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

Steam Turbines: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction-power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-Laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency.

UNIT – IV

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 – calculation of blade height.

Steam Condensers: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.

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UNIT – V

Gas Turbines: Simple gas turbine plant – ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –closed and semi-closed cycles – merits and demerits, types of combustion chambers.

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 engines – needs and demands met by turbo jet – schematic diagram, thermodynamic cycle, performance evaluation, thrust augmentation – methods.

Rockets: Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines.

TEXT BOOKS:

1. Thermodynamics and Heat Engines/R.Yadav, Volume -II /Central Publishing House
2. Gas Turbines /V.Ganesan /TMH
3. Heat Engineering /V.P Vasandani and D.S Kumar/Metropolitan Book Company, New Delhi

REFERENCES:

1. Gas Turbines and Propulsive Systems /P.Khajuria & S.P.Dubey /Dhanpatrai
2. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman
3. Thermal Engineering-R.S Khurmi, &J S Gupta/S.Chand.
4. Thermal Engineering-P.L.Bellaney/ Khanna publishers
5. Thermal Engineering-M.L.Marthur & Mehta/Jain bros. Publishers
6. Thermal Engineering / RK Rajput/ Lakshmi Publications

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V Semester   **L   T   P   C**

                                                   3   0   0   3

METAL CUTTING AND MACHINE TOOLS (18ME5T04)

UNIT I: Material Removal Processes:

Metal Cutting: Single and multi-point cutting, orthogonal cutting, various force components, chip formation and is types, tool wear and tool life, Merchants force diagram, machinability, cutting tool materials, cutting fluids, coatings.

UNIT II: Machining processes for round shapes:

Lathe and Lathe Operations: Principles of working, specifications, types of lathes, operations performed, work holders and tool holders. Taper turning, thread turning attachments for lathes. machining time calculations. Turret and capstan lathes - Principle of working, collect chucks, other work holders - tool holding devices.

Boring and Boring Machines- Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of boring tools

Drilling and Drilling Machines: Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of twist drill.

Reaming and Reamers: Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of reamers.

Taping and Taps: Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of taps.

UNIT III: Machine processes for other shapes:

Milling operations and Milling machines - Principles of working, specifications, classifications of milling machines, machining operations, types and geometry of milling cutters, methods of indexing, and accessories to milling machines, machining time calculations.

Shaping, Slotting and planning machines - Principles of working - principal parts, specification, classification, operations performed, machining time calculations

UNIT IV: Abrasive Machining:

Grinding and grinding machines: Grinding process, types of grinding machines, grinding process

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parameters, honing, lapping, other finishing processes.

UNIT V

Jigs and Fixtures Principles of design of Jigs and fixtures and uses, 3-2-1 principle of location and clamping, classification of Jigs & Fixtures, types of clamping and work holding devices, typical examples of jigs and fixtures.

Textbooks:

1. P.N. Rao, Manufacturing Technology: Metal Cutting and Machine Tools, (Volume 2), 3/e, Tata McGraw-Hill Education, 2013

2. R.K. Jain and S.C. Gupta, Production Technology, 17/e, Khanna Publishers, 2012.

Reference books:

1. Kalpakzian S and Schmid SR, Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

2. Milton C.Shaw , Metal Cutting Principles, 2/e, Oxford, 2012

3. Hindustan Machine Tools, Production Technology, TMH, 2001

4. V.K.Jain, Advanced Machining Process,12/e, Allied Publications, 2010

5. AB. Chattopadhyay, Machining and Machine Tools, 2/e, Wiley, 2017

6. Halmi A Yousuf & Hassan, , Machine Technology: Machine Tools and Operations, CRC Press Taylor and Francis Group, 2008

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V Semester	L	T	P	C
	3	0	0	3

INTERNET OF THINGS (18ME5T05)
(OPEN ELECTIVE-2)

UNIT-I
INTRODUCTION TO INTERNET OF THINGS (IoT):
Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT EnablingTechnologies,IoTlevelsanddeployment,domainspecificIoTs.

UNIT-II
IoT AND M2M:
Introduction, M2M, difference between IoT and M2M, software defined networking (SDN) and network function virtualization (NFV) for IoT, basics of IoT system management with NETCONF-YANG.

UNIT-III
IoT PLATFORMS DESIGN METHODOLOGY:
IoT Architecture: State of the art introduction, state of the art; Architecture reference model: Introduction, reference model and architecture, IoT referencemodel.Logical design using Python: Installing Python, Python data types and data structures, control flow, functions, modules, packages, file handling.

UNIT-IV
IoT PHYSICAL DEVICES AND ENDPOINTS:
Introduction to Raspberry Pi interfaces (Serial, SPI, I2C), programming Raspberry PI with Python, other IoT devices.

UNIT-V
IoT PHYSICAL SERVERS AND CLOUD OFFERINGS:
Introduction to cloud storage models and communication APIs, WAMP –AutoBahn for IoT, Xively cloud for IoT, case studies illustrating IoT design –home automation, smart cities, smart environment.

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Text Books:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1stEdition, 2014.

2. Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 3rdEdition, 2014.

Reference Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw HillHigher Education

2. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", John Wiley andSons2014.

Web References:

1.https://www.upf.edu/pra/en/3376/22580.

2. https://www.coursera.org/learn/iot

3. https://bcourses.berkeley.edu.

4. www.innovianstechnologies.com.

E-Text Books:

1. https://mitpress.mit.edu/books/internet-things

2. https://www.apress.com/in

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V Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

EMPLOYABILITY SKILLS-1 (18ME5T06)
(Quantitative Aptitude and Reasoning)
(OPEN ELECTIVE-2)

Unit-I: Divisibility and remainder rules of numbers,

Unit digit , square root, cube root and simplification of numbers,

HCF and LCM of numbers, Averages and Percentages

Alphabetical and miscellaneous series, Coding and decoding and Blood Relations

Unit-II: Profit & loss, Simple interest and Compound interest

Direction, Order and Ranking, Sitting arrangement and Puzzle

Unit-III: Ratio & proportions, Partnership, Alligation and mixtures and Ages**.**

Data sufficiency, Inequalities and Decision making .

Unit-IV: Time and work, Pipes & cisterns and Time and distance .

Syllogism, Statement and course of action and Statement and Assumption.

Unit-V: Boats and streams, Areas, Volume and surface areas.

Statement and argument, Cause and effect and Drawing inference.

Text Books:

1. "Objective Arithmetic" by R.S. Agarwal, S. Chand Publications.
2. Verbal and non-verbal Reasoning, R.S. Agarwal, S. Chand Publications

Reference Books:

1. Quantitative Aptitude by Dinesh Khattar, Pearson Education.
2. Quantitative Aptitude by Abhjit Guha.
3. Fast Track objective Arithmetic, Rajesh Verma, Arihant publications.

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V Semester	L	T	P	C
	3	0	0	3

DESIGN THINKING AND PROJECT INNOVATION(18ME5T07)
(OPEN ELECTIVE-2)

Unit 1: An Insight into Design, History of Modern Design: Early Innovations Industrialization, New Materials, Nature of Design, Work Design for Survival and Survival through Design.

Unit 2: Design Thinking: Design Thinking as a systematic Approach to Innovation, Brainstorming, Visual Thinking, The Design Challenges, Product Development.

Unit 3: Innovation, Art of Innovation, Strategies for Creativity,Teams for Innovation, Design Alternatives, Decision Making for New Design.

Unit 4: Design Thinking for strategic Innovation, Application of Designs, Thinking In Business and Strategy,Linking Design Thinking Solution to Business Challenges, Enterprise Creativity Competitive Logic of business Strategy. Design Thinking for Startups.

Unit 5: Creative Thinking Techniques:Linear Thinking, Constraints in Design, Design Thinking to meetCorporate Needs, Designing today for tomorrow.

Reference Books:

1) David Raizman- History of Modern Design, Laurence King Publishing Ltd. Ed2 (2010)

2)Tim Brown, Change by Design, Harper Bollins (2009)

3)Tom Kelley with Jonathan Littman, Ten Faces of Innovation, Currency Books (2006)

4) Jimmy Jain, Design Thinking for startups, Notion Press (2018)

5)Tom Kelley & Jonathan Leman, The Art of Innovation, Harper Collins Business,(2001)

6) Michael Michalko,Thinker toys, Ten Speed Press (2006)

7)Idris Mootee, Design Thinking for Strategic Innovation John Willey & Sons (2013).

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V Semester	L	T	P	C
	0	0	3	1.5

THEORY OF MACHINES LAB(18ME5L08)

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis
4. To determine the frequency of undamped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel
8. To plot follower displacement vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage , velocity ratio and efficiency
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears

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V Semester   **L   T   P   C**

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MACHINE TOOLS LAB (18ME5L09)

1. Demonstration of construction and operations of general purpose machines : Lathe, drilling machine, milling machine, shaper, slotting machine, cylindrical grinder and surface grinder.

2. Measure the characteristic features of lathe with simple step turning operation.

3. Job on step turning, taper turning, knurling, thread cutting on lathe machine.

4. Perform drilling, reaming and tapping operations.

5. Job on milling (Groove cutting/Gear cutting).

6. Job on shaping and planning.

7. Job on slotting.

8. Job on cylindrical and surface grinding.

9. Job on grinding of tool angles.

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V Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

COMMUNICATION SKILLS LAB (18ME5L10)

1. Debate
2. Resume Preparation
3. JAM
4. Group Discussion
5. Interview Skills

Suggested Reading:

Interact- English Lab Manual for Undergraduate Students, Orient Blackswan 2016

V Semester

	L	T	P	C
	2	0	0	0

ESSENCE OF INDIAN TRADITIONAL CULTURE(18ME5T11)

Unit-I:

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

Unit-II:

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Unit-III:

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

Unit-IV:

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Unit-V:

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

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Reference Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.

3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002

4. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

E-Resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM 2.http://nptel.ac.in/courses/121106003/

VI

SEMESTER

SYLLABUS

VI Semester

L	T	P	C
2	1	0	3

DESIGN OF TRANSMISSION ELEMENTS(18ME6T01)

UNIT – I

BEARINGS: Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

UNIT – II

ENGINE PARTS: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners,

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c –clamps**.**

UNIT – III

POWER TRANSMISSIONS SYSTEMS, PULLEYS: Transmission of power by belt and rope drives , transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives

DESIGN OF POWER SCREWS: Design of screw, square ACME, buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

UNIT – IV

SPUR & HELICAL GEAR DRIVES: Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears – estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

UNIT – V

MACHINE TOOL ELEMENTS: Levers and brackets: design of levers – hand levers-foot lever – cranked lever

– lever of a lever loaded safety valve- rocker arm straight – angular- design of a crank pin – brackets- hangers- wall boxes.

Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums

Note: Design data book is permitted for examination Text Books:

1. Machine Design/V.Bandari/TMH Publishers
2. Machine Design/ NC Pandya & CS Shaw/ Charotar publishers
3. Design data book.

References:

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education
3. Design of machine elements- spots/Pearson Publications
4. Machine Design-Norton/Pearson Publications

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VI Semester	**L**	**T**	**P**	**C**
	2	**1**	**0**	**3**

HEAT TRANSFER(18ME6T02)

Unit I

Introduction: Basic modes of heat transfer- rate equations- generalized heat conduction equation - steady state heat conduction solution for plain and composite slabs - cylinders - critical thickness of insulation- heat conduction through fins of uniform cross section- fin effectiveness and efficiency.

Unsteady State Heat Transfer Conduction- Transient heat conduction- lumped system analysis and use of Heisler charts.

Unit II

Convection: Basic concepts of convection–heat transfer coefficients - types of convection –forced convection and free convection.

Forced convection in external flow–concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders. Fluid friction – heat transfer analogy, approximate solution to laminar boundary layer equation for external flow. Internal flow – Use of empirical relations for convective heat transfer in horizontal pipe flow.

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 III

Radiation: Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies – shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect.

Unit IV

Heat Exchangers: Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods- fouling in heat exchangers.

Unit V

Boiling and Condensation: Different regimes of boiling- nucleate, transition and film boiling – condensation - filmwise and dropwise condensation.

Mass Transfer: Conservation laws and constitutive equations - Fick's law of diffusion, isothermal equi-mass - Equimolal diffusion- - diffusion of gases and liquids- mass transfer coefficient.

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Text Book(s)

1. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.

2. F. P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6/e, John Wiley, 2007.

References:

1. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill,2008.

2. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.

3. S.P. Sukhatme, A Textbook of Heat Transfer, Universities Press, 2005

4. Lienhard and Lienhard, A Heat and Mass Transfer, Cambridge Press, 2011.

5. C.P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer databook, New Age Publications, 2014

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VI Semester   **L   T   P   C**

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METROLOGY AND MEASUREMENTS(18ME6T03)

UNIT I

Concept of Measurement: General concept-generalized measurement system, units and standards, measuring instruments, sensitivity, readability, range of accuracy, precision, static and dynamic response, repeatability, systematic and random errors, correction, calibration, terminology and limits fits and tolerances, hole basis and shaft basis system, interchangeability.

Linear and Angular Measurement: Linear measuring instruments: Vernier instruments, micrometers, slip gauges, tool makers microscope. Comparators: Mechanical, pneumatic and electrical. Angular measurements: Sine bar, bevel protractor and angle dekkor, rollers and spheres used to determine the tapers.

UNIT II

Flatness Measurement: Measurement of flatness – straight edges – surface plates, optical flat and autocollimators, interferometers and their applications.

Surface Roughness Measurement: Terminology systems, differences between surface roughness and surface waviness- Numerical assessment of surface finish - CLA, R,M,S Values-Ra , Rz values, Methods of measurement of surface finish-profilograph, talysurf, BIS symbols for indication of surface roughness, classification of automatic inspections systems, co-ordinate- measuring machines, non-contact inspection techniques-machine vision, laser scanning systems.

UNIT III

Metrology of Screw Threads:

Screw thread measurements: Elements of threads, errors in screw threads, various methods for measuring external and internal screw threads, screw thread gauges.

Gear Measurement: Gear tooth terminology, measurement of gear elements-runout, lead, pitch backlash, profile, pressure angle, tooth thickness, diameter of gear, constant chord and base tangent method.

UNIT IV

Measurement of Displacement: Theory and construction of various transducers to measure

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displacement - Piezo electric, inductive, capacitance, resistance, ionization and photoelectric transducers, calibration procedures.

Measurement of Speed: Mechanical tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer.

Measurements of Strain: Various types of electrical strain gauges, gauge factor, method of usage of resistance strain gauge for bending, compressive and tensile strains, usage for measuring torque, strain gauge rosettes.

UNIT V

Measurement of Force: Direct method - analytical balance, platform balance; elastic members – load cells, cantilever beams and proving rings.

Measurement of Torque: Torsion bar dynomometer, servo controlled dynamometer and absorption dynamometer.

Measurement of Temperature: Standards and calibration, thermal expansion methods, thermo electric sensors (thermocouples), Electrical Resistance sensors, Junction semiconductor sensors, Digital thermometers, Radiation methods.

Measurement of Pressure and Sound: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, Elastic transducers, vibrating cylinder, resonant transducers, High and low pressure measurement.

Textbooks:
1. Beckwith, Marangoni, Linehard, Mechanical Measurements, 6/e, PHI, 2013.
2. R.K. Jain, Engineering Metrology, 20/e, Khanna Publishers, 2013.

Reference Books:
1. Mahajan, Engineering Metrology, 2/e, Dhanpat Rai, 2013.
2. S.Bhaskar, Basic Principles - Measurments and Control Systems, Anuradha Publications, 2014.
3. Anand K Bewoor & Vinay A Kulkarni, Metrology & Measurement, 15/e, McGrawHill, 2015

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VI Semester	L	T	P	C
	3	0	0	3

ROBOTICS(18ME6T04)
(OPEN ELECTIVE-3)

UNIT-I

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors. Function line diagram representation of robot arms.

UNIT – II

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation, joint coordinates and world coordinates. Forward and inverse kinematics – problems.

UNIT – III

Differential transformation and manipulators, Jacobians – problems.

Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT IV

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion.

Robot programming, languages and software packages

UNIT V

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection. Future applications

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Text Books:

1.   Industrial Robotics / Groover M P /Pearson Edu.

2.   Robotics and Control / Mittal R K & Nagrath I J / TMH.

References:

1.   Robotics / Fu K S/ McGraw Hill.

2.   Robotic Engineering / Richard D. Klafter, Prentice Hall

3.   Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd.

4.   Introduction to Robotics / John J Craig / Pearson Edu.

VI Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

RAPID PROTOTYPING(18ME6T05)
(OPEN ELECTIVE-3)

UNIT – I

Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

RP Software: Need for RP software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, SolidView, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

UNIT – II

Solid and Liquid Based RP Systems**:** Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications. Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

UNIT – III

Powder Based RP Systems**:** Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

Other RP Systems: Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballastic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

UNIT – IV

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact

Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

UNIT – V

Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc.

RP Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Text Books:

1. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e Edition, World Scientific Publishers, 2003.
2. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st Edition, Springer, 2010.
3. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.
4.

Reference Books:

1. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.
2. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid tooling, Springer, London 2001.
3. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003.
4. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications,

VI Semester

L	T	P	C
3	0	0	3

GREEN ENGINEERING SYSTEMS(18ME6T06)
(OPEN ELECTIVE-3)

UNIT - I
INTRODUCTION:

Solar Radiation: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT - II

Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling techniques, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, types of winds, wind data measurement.

UNIT - III

Bio-Mass: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio-fuels, I.C. engine operation and economic aspects.

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles of utilization, setting of OTEC plants.

Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT - IV

Energy Efficient Systems:

Electrical Systems: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating,

ventilation and air conditioning), demand site management.

Mechanical Systems: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, environmental friendly and energy efficient compressors and pumps.

UNIT - V

Energy Efficient Processes: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

TEXT BOOKS:

1. Sukhatme S.P., & Nayak J. K., Solar Energy – Principles of Thermal Collection and Storage, TMH, 2008.
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006.
3. Davim J. P., Green Manufacturing Processes and Systems, Springer, 2013.

REFERENCE BOOKS:

1. Jagadeesh K. S., Venkata Rama Reddy B. V., & Nanjunda Rao, K. S., Alternative Building Materials and Technologies, New Age International (P) Ltd., 2014
2. Goswami Y. D., Krieth F., & John F Kreider, Principles of Solar Engineering, CRC Press (Taylor & Francis), 2015
3. Desai A. V., Non-Conventional Energy, New Age International (P) Ltd.
4. Ramesh & Kumar, Renewable Energy Technologies, Narosa Publishing House, 1997.
5. Rai G. D., Non-conventional Energy Source, Standard Publishers, 2009.
6. Twidell J., & Weir T., Renewable Energy Resources, 2nd Edition, BSP Books Pvt. Ltd, 2006.
7. Hoogers G., Fuel Cell Technology–Hand Book, CRC Press (Taylor & Francis), 2019.

VI Semester	L	T	P	C
	3	0	0	3

ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS(18ME6T07)
(OPEN ELECTIVE-4)

UNIT-I

Introduction : AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT–II

Searching : Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Greedy best first search, A* search Game Playing: Adversial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, cutting of search.

UNIT–III

Knowledge Representation & Reasons logical Agents, Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in proposional logic, Resolution, Forward & Backward Chaining. First order logic. Inference in first order logic, propositional Vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution.

UNIT–IV

Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units.

UNIT–V

Feed forward Neural Networks:

Introduction, Analysis of pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of pattern storage Networks. Analysis of Pattern Mapping Networks. Feedback Neural Networks:

Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks.

TEXT BOOKS :

1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education.

2. Artificial Neural Networks B. Yagna Narayana, PHI

REFERENCES :

1. Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).

2. Artificial Intelligence and Expert Systems – Patterson PHI.

3. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.

4. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.

5.Neural Networks Simon Haykin PHI

6. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition.

VI Semester	L	T	P	C
	3	0	0	3

NANO TECHNOLOGY(18ME6T08)
(OPEN ELECTIVE-4)

UNIT I

Introduction to Nano technology:

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges, and Future Prospects.

UNIT – II Properties of Nano Materials

Unique Properties of Nanomaterials: Microstructure and Defects in nanocrystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple, and disclinations, Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility, Magnetic Properties: Soft magnetic Nanocrystalline alloy, Permanent magnetic Nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

UNIT – III Processing of nano materials

Synthesis Routes : Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Solgel method ,Self assembly, Top down approaches: Mechanical alloying, Nano-lithography, Consolidation of Nanopowders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

UNIT-IV   Nanomaterials for Energy Conversion Systems

Issues and Challenges of functional Nanostructured Materials for electrochemical Energy, Conversion Systems, Fuel Cells, Principles and nanomaterials design for Proton exchange membrane fuel cells (PEMFC); Direct methanol fuel cells (DMFC).

UNIT-V Nanomaterials for Energy Storage

Issues and Challenges of functional Nanostructured Materials for electrochemical Energy Storage Systems, Primary and Secondary Batteries (Lithium ion Batteries), Cathode and anode materials, Nanostructured Carbon based materials, Nano-Oxides, Novel hybrid electrode materials, Current status and future trends.

TEXTBOOK

1. Electrochemical methods: Fundamentals and Applications, Allen J.Bard and Larry R. Faulkner, 2nd Edition John Wiley & Sons. Inc (2004)

2. D. Linden Ed., Handbook of Batteries, 2nd edition, McGraw-Hill, New York (1995)

3. G.A. Nazri and G. Pistoia, Lithium Batteries: Science and Technology, Kulwer Acdemic Publishers, Dordrecht, Netherlands (2004).

4. J. Larmine and A. Dicks, Fuel Cell System Explained, John Wiley, New York (2000).

REFERENCE BOOK

1. Science and Technology of Lithium Batteries-Materials Aspects: An Overview, A. Manthiram, Kulwer Academic Publisher (2000).

2. M. S. Whittingham, A. J. Jacobson, Intercalation Chemistry, Academic Press, New York (1982).

3. M. Wakihara, O. Yamamoto, (Eds.) Lithium Ion Batteries: Fundamentals and Performance, Wiley – VCH , Weinheim (1998).

VI Semester   **L   T   P   C**

                                         3   0   0   3

EMPLOYABILITY SKILLS-2 (18ME6T09)
(OPEN ELECTIVE-4)

Unit-1 What Is A Program?

Introduction, Processing, System, Block diagram of a computer, Peripheral Devices, Booting, Flowcharts, Algorithms, Multi Processing, Multi Threading,.

Unit-2. The Problem Domain

Introduction , System Software, Networking and Web Applications Software, Embedded Software, Reservation Software, Business Software, Entertainment Software, Artificial Intelligence Software, Scientific Software, Utilities Software, Document Management Software

Unit-3. Storing Information

Introduction, Need for storing, File System, DBMS, Advantages and Disadvantages, Permissions, DDL and DML Commands.

Unit-4. Logic And Errors

Introduction, Decision Making Capacity, Business Logic, Application Logic, Error handling, Recoverable and non-recoverable errors, Damage Control.

Unit-5. Proving Programs With Tests

Introduction, Purpose of Testing, Flow Graphs and Path Testing, Transaction Flow Testing, Domain Testing, Manual and Automated Testing.

VI Semester	L	T	P	C
	0	0	3	1.5

METROLOGY AND INSTRUMENTATION LAB(18ME6L10)

LIST OF EXPERIMENTS

- Use of gear teeth Vernier calipers and checking the chordal addendum and chordal height of spur gear.
- Alignment test on the lathe and milling machine using dial indicators
- Study of Tool makers microscope and its application
- Angle and taper measurements by Bevel protractor, Sine bars.
- Use of spirit levels in finding the flatness of the surface plate.
- Surface roughness measurement by Talysurf instrument.
- Calibration of Strain Gauge for load measurement.
- Study and calibration of rotameter for flow pressure.
- Calibration of transducer or thermocouple for temperature measurement.
- Calibration of LVDT transducer for displacement measurement.
- Calibration of capacitive transducer for angular measurement.
- Calibration of photo and magnetic speed pickups for the measurement of speed.

VI Semester	L	T	P	C
	0	0	3	1.5

HEAT TRANSFER LAB(18ME6L11)

List of Experiments

1. Determine the overall heat transfer coefficient across the width of composite wall

2. Determine the thermal conductivity of a metal rod

3. Determine the thermal conductivity of insulating powder material through concentric sphere apparatus

4. Determine the thermal conductivity of insulating material through lagged pipe apparatus

5. Determine the efficiency of a pin fin in natural and forced convection.

6. Determine the heat transfer coefficient for a vertical cylinder in natural convection

7. Determine the heat transfer coefficient in forced convection of air in a horizontal tube.

8. Determine the heat transfer coefficients on film and drop wise condensation apparatus.

9. Determine the effectiveness of a parallel and counter flow heat exchanger.

10. Study the pool boiling phenomenon and different regimes of pool boiling.

11. Experiment on pool boiling

12. Determine the emissivity of the test plate surface.

13. Experiment on Stefan-Boltzmann apparatus

14. Determine the heat transfer rate coefficient in fluidized bed apparatus

VI Semester	L	T	P	C
	2	0	0	0

DISASTER MANAGEMENT(18ME6T12)

UNIT-I :

Natural Hazards And Disaster Management:Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.

UNIT-II :

Man Made Disaster And Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management. Impact of disaster on poverty and deprivation- Climate change adaptation and human health -Exposure , health hazards and environmental risk-Forest management and disaster risk reduction

UNIT-III :

Risk And Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

UNIT-IV :

Role Of Technology In Disaster Managements:Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment- multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.

UNIT-V :

Education And Community Preparedness:Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.

TEXT BOOKS

- 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy(2009),Universities press.
- 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
- 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

REFERENCE BOOKS

- 'Disaster Management' edited by H K Gupta (2003),Universities press.

VI Semester

	L	T	P	C
	2	0	0	0

SUMMER INTERNSHIP (18ME6I13)

VII

SEMESTER

SYLLABUS

VII Semester	L	T	P	C
	3	0	0	3

CAD/CAM(18ME7T01)

UNIT I

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

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

UNIT II:

Geometric Modelling:

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

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

UNIT III

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

UNIT IV

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

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

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

UNIT V

Automation: Anatomy and configuration of robot, characteristics of robots, grippers, application of robots in manufacturing, robot programming languages. Computer integrated manufacturing (CIM): Elements of

CIM, Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI) and expert systems in CIM.

Text books:

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

Reference books:

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

VII Semester	L	T	P	C
	3	0	0	3

OPERATIONAL RESEARCH(18ME7T02)

UNIT – I

Development – definition– characteristics and phases – types of operation research models –applications.
 ALLOCATION: Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT – II

 TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem-traveling salesman problem.

SEQUENCING – Introduction – flow –shop sequencing – n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through 'm' machines.

UNIT – III

 REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT – IV

 THEORY OF GAMES: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

WAITING LINES: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.

SIMULATION: Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages – simulation languages.

UNIT – V

 INVENTORY : Introduction – single item – deterministic models – purchase inventory
models with one price break and multiple price breaks – shortages are not allowed –
stochastic models – demand may be discrete variable or continuous variable – instantaneous
production. Instantaneous demand and continuous demand and no set up cost. ABC & VED
Analysis.

DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality –
applications of dynamic programming- capital budgeting problem – shortest path problem –
linear programming problem.

TEXT BOOKS:

 • Operations Research-An Introduction/Hamdy A Taha/Pearson publishers

• Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan
publishers India Ltd

REFERENCES:

- Introduction to O.R/Hiller & Libermann/TMH
- Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson
  Education.
- Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan &   Lawrence
  Friedman/Wiley
- Operations Research / R.Pannerselvam/ PHI Publications.
- Operations Research / Wagner/ PHI Publications.
- Operation Research /J.K.Sharma/MacMilan Publ.
- Operations Research/ Pai/ Oxford Publications
- Operations Research/S Kalavathy / Vikas Publishers
- Operations Research / DS Cheema/University Science Press
- Operations Research / Ravindran, Philips, Solberg / Wiley publishers

VII Semester	L	T	P	C
	3	0	0	3

FINITE ELEMENT METHODS(18ME7T03)
(PROFESSIONAL ELECTIVE -1)

UNIT - I

Introduction to finite element methods for solving field problems, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, The Rayleigh-Ritz method, Formulation of Finite Element Equations.

One dimensional problems: Finite element modeling coordinates and shape functions. Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT - II

Analysis of trusses: Stiffness Matrix for plane truss element. Stress Calculations and Problems.

Analysis of beams: Element Stiffness Matrix for two noded, two degrees of freedom per node beam element and simple problems.

UNIT - III

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses.Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.Two dimensional four nodedIsoparametric elements and problems.

UNIT - IV

Steady state heat transfer analysis: One dimensional analysis of slab and fin, two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion

UNIT V

Dynamic analysis: Formulation of finite element model,element –mass matrices,evaluation of Eigen values and Eigen vectors for a stepped bar truss.

3D Problems: Finite Elementformulation for stress analysis, Convergence requirements, mesh generation, techniques such as semi automatic and fully automatic use of software's such as ANSYS,NISA,NASTRAN.

TEXT BOOKS

1. Chandraputla, Ashok &Belegundu,Introduction to Finite Element in Engineering, Prentice Hall.

2. S.S.Rao, The Finite Element Methods in Engineering,Elsevier Butterworth -Heinemann 2nd Edition, 2011.

REFERENCE BOOKS

1. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993.

1. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3rd Edition, John Wiley, New York, 1989.

2. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs,1982.

3. T J R Hughes, the Finite Element Method, Prentice-Hall, Englewood Cliffs, NJ, 1986.

4. O C Zienkiewicz and R L Taylor, the Finite Element Method, 3rd Edition. McGraw-Hill, 1989.

VII Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

GAS DYNAMICS AND JET PROPULSION(18ME7T04)
PROFESSIONAL ELECTIVE -1

UNIT - I

Introduction to Gas Dynamics: control volume and system approaches acoustic waves and sonic velocity - Mach number - classification of fluid flow based on Mach number - Mach cone-compressibility factor - general features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

UNIT - II

Isentropic Flow of an Ideal Gas: basic equation - stagnation enthalpy, temperature, pressure and density-stagnation, acoustic speed - critical speed of sound- dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function.

Steady one dimensional isentropic flow with area change-effect of area change on flow parameters-chocking- convergent nozzle - performance of a nozzle under decreasing back pressure –De-lavel nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies.

UNIT - III

Simple Frictional Flow: adiabatic flow with friction in a constant area duct-governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct-governing equations - limiting conditions.

Steady one dimensional flow with heat transfer in constant area ducts- governing equations - Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy.

UNIT - IV

Effect of Heat Transfer on Flow Parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - Rankine Hugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.

UNIT - V

Propulsion: Air craft propulsion: - types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines,

exhaust systems. Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion

- rocket engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

TEXT BOOKS:

1   Compressible fluid flow /A. H. Shapiro / Ronald Press Co., 1953
2   Fundamentals of compressible flow with aircraft and rocket propulsion/S. M. Yahya/New Age international Publishers, 2003
3   Fundamental of Gas dynamics-2nd edition/ M J Zucker/ Wiley publishers, 2002

REFERENCES:

1   Elements of gas dynamics / HW Liepman & A Roshko/Wiley, 1957
2   Aircraft & Missile propulsion /MJ Zucrow/Wiley, 1958
3   Gas dynamics / M.J. Zucrow & Joe D.Holfman / Krieger Publishers, 1976.

VII Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRODUCTION PLANNING AND CONTROL(18ME7T05)
PROFESSIONAL ELECTIVE -1

UNIT – I

Introduction : Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

UNIT – II

Forecasting – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitative methods.

UNIT – III

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems. Introduction to MRP I,MRP II & ERP, LOB (Line of Balance), JIT and CANBAN system.

UNIT –IV

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading

UNIT – V

Scheduling Policies – Techniques, Standard scheduling methods, line balancing, Aggregate planning, Expediting, controlling aspects.

Dispatching – Activities of dispatcher – Dispatching procedure – follow up – definition – Reason for existence of functions – types of follow up.

TEXT BOOKS :

1. Elements of Production Planning and Control / Samuel Eilon.
2. Manufacturing,Planning and Control, Partik Jonsson Stig-Arne Mattsson, Tata Mc Graw Hill.

REFERENCES :

1. Operations Management – S.N. Chary.

2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.

3. Reliability Engineering & Quality Engineering by Dr. C. Nadha Muni Reddy and Dr. K. Vijaya

Kumar Reddy, Galgotia Publications, Pvt., Limited.

4. Production Control A Quantitative Approach / John E. Biegel.

5. Production Control / Moore.

VII Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

ADVANCED MATERIALS(18ME7T06)
PROFESSIONAL ELECTIVE -2

UNIT-I
INTRODUCTION TO COMPOSITE MATERIALS:

Introduction, classification: polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber reinforced composites and nature-made composites, and applications and Reinforcements**:** Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and boron carbide fibres.

UNIT-II POLYMERS

Introduction to Polymer composites, thermoplastics, thermosetting plastics, manufacturing of PMC, MMC & CCC and their applications. Miscellaneous manufacturing methods: Autoclave, tape production, moulding methods and hand layup.

UNIT-III
MACROMECHANICAL ANALYSIS OF A LAMINA: Introduction, generalized Hooke's law, reduction of Hooke's law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina, laminate-laminate code.

UNIT-IV
FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification

different systems-preparation-properties and applications of functionally graded materials.

SHAPE MEMORY ALLOYS: Introduction-shape memory effect-classification of shape memory alloys

composition-properties and applications of shape memory alloys.

UNIT-V
NANO MATERIALS:

Introduction-properties at nano scales-advantages & disadvantages-applications in comparison with bulk materials (nano – structure, wires, tubes, composites). state of art nano advanced- topic delivered by student.

Text Books:

1. Nano material /A.K. Bandyopadyay/New age Publishers

2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH

3. Engineering Mechanics of Composite Materials / Isaac and M Daniel/Oxford University Press

References:

1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York, 1975.

2. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY 1969

3. Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-Interscience, New York, 1980

4. Mechanics of Composite Materials - Second Edition (Mechanical Engineering) /Autar K.Kaw / CRC Press

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VII Semester

	L	T	P	C
	3	0	0	3

POWER PLANT ENGINEERING(18ME7T07)
PROFESSIONAL ELECTIVE -2

UNIT – I

Introduction to the Sources of Energy: Resources and Development of Power in India. Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection.

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection and Safety Regulations.

UNIT – II

Steam Power Plant: Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipment's, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant Combustion Process: Properties of Coal - Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders

UNIT – III

Diesel Power Plant: Diesel Power Plant: Introduction - IC Engines, Types, Construction- Plant Layout with Auxiliaries - Fuel Storage

Gas Turbine Plant: Introduction - Classification - Construction - Layout with Auxiliaries - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT – IV

Hydro Electric Power Plant: Water Power - Hydrological Cycle / Flow Measurement - Drainage Area

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Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways.

Hydro Projects and Plant: Classification - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

UNIT – V

Power from Non-Conventional Sources: Utilization of Solar Collectors- Principle of its Working, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation.

Nuclear Power Station: Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

Types of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

TEXT BOOKS:

1. P.K. Nag, Power Plant Engineering, 3/e, TMH, 2013.
2. Arora and S. Domkundwar, A course in Power Plant Engineering, Dhanpat Rai & Co (P) Ltd, 2014

REFERENCE BOOKS:

1. Rajput, A Text Book of Power Plant Engineering, 4/e, Laxmi Publications, 2012.
2. Ramalingam, Power plant Engineering, Scietech Publishers, 2013
3. P.C. Sharma, Power Plant Engineering, S.K. Kataria Publications, 2012.

VII Semester	L	T	P	C
	3	0	0	3

OPTIMIZATION TECHNIQUES THROUGH MATLAB(18ME7T08)
PROFESSIONAL ELECTIVE -2

UNIT – I

Introduction to MAT LAB: Overview, MATLAB Preliminaries, Basics of MATLAB, Beyond the Basics of MATLAB, Popular Functions and Commands, Plotting using MATLAB, Optimization with MATLAB.

UNIT – II

Introduction to Optimization: Statement of an optimization problem, Classifications of optimization Problems: Single variable optimization, Multi variable optimization with no constraints, Multi variable optimization with equality constraints, Multi variable optimization with inequality constraints, Convex and Concave programming.

UNIT – III

Single Variable Optimization: Finite difference method, Central difference method, Runge-Kutta method, interval halving method, golden section method with MATLAB code.

UNIT – IV

Multi Variable Optimization: Conjugate gradient method, Newton's method, Powell's method, Flectcher-Reeves method, Hook and Jeeves method, interior penalty function with MATLAB code.

UNIT – V

Evolutionary Algorithms: Overview, Genetic Algorithms: Basics of Genetic Algorithms, Options in MATLAB, Multi Objective Optimization using Genetic Algorithms, Ant Colony Optimization, Simulated Annealing, Particle Swarm Optimization.

TEXT BOOKS:

1. Rao V.Dukkipati, MATLAB: An Introduction with Applications, Anshan, 2010.
2. Achille Messac, Optimization in practice with MATLAB, Cambridge University Press, 2015.
3. Jasbir S Arora, Introduction to optimum design, 2/e. Elsevier, 2004.

REFERENCES:

1. Cesar Perez Lopez, MATLAB Optimization Techniques, Academic press, Springer publications, 2014.

2. Steven C.Chapra, Applied Numerical Methods with MATLAB for Engineers and scientists, 4/e, McGraw-Hill Education, 2018.

VII Semester	L	T	P	C
	3	0	0	3

MECHATRONICS(18ME7T09)
OPEN ELECTIVE-5

UNIT – I

Introduction: Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

UNIT – II

Sensors: Static characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

UNIT – III

Actuators: Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys, Selection criteria for actuators.

UNIT – IV

Microprocessors, Microcontrollers and Programmable Logic Controllers: Architecture of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

UNIT – V

Micro Electro Mechanical Systems (MEMS): History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, Applications: Lab on chip.

Text books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering , WBolton, 3/e Pearson Education Press, 2005.

2. Devadas Shetty and Richard A Kolk, Mechatronic System Design, 2/e, Cengage learning, 2010.

3. Clarence W. de Silva, Mechatronics an Integrated Approach, CRC Press, 2004.

4. James J Allen, Micro Electro Mechanical Systems Design, CRC Press Taylor & Francis group, 2005.

5. Ganesh S Hedge, Mechatronics, Jones & Bartlett Learning, 2010.

VII Semester	L	T	P	C
	3	0	0	3

MICRO-ELECTRO-MECHANICAL SYSTEMS(18ME7T10)
OPEN ELECTIVE-5

UNIT – I :

INTRODUCTION: Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

UNIT – II :

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

UNIT – III:

MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS: Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

UNIT – IV :

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel,

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microfluid dispenser, micro needle, molecular gate, micro pumps.

RADIO FREQUENCY (RF) MEMS:RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

UNIT – V :

CHEMICAL AND BIO MEDICAL MICRO SYSTEMS: Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemoresistors, chemocapacitors, chemotransistors, electronic nose (E-nose), mass sensitive chemosensors, fluroscence detection, calorimetric spectroscopy.

TEXT BOOK

- MEMS, Nitaigour Premchand Mahalik, TMH Publishing co.

REFERENCE BOOKS

- Foundation of MEMS, Chang Liu, Prentice Hall Ltd.
- MEMS and NEMS, Sergey Edwrd Lyshevski, CRC Press, Indian Edition.
- MEMS and Micro Systems: Design and Manufacture, Tai-Ran Hsu, TMH Publishers.
- Introductory MEMS, Thomas M Adams, Richard A Layton, Springer International Publishers.

VII Semester	L	T	P	C
	3	0	0	3

SOLAR ENERGY SYSTEMS(18ME7T10)
OPEN ELECTIVE-5

UNIT – I

Solar Radiation and Collectors: Solar angles – Sun path diagrams – Radiation - extra-terrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods-evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.

UNIT – II

Solar Thermal Technologies: Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying.

UNIT – III

Solar PV Fundamentals: Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics.

UNIT – IV

SPV System Design and Applications: Solar cell array system analysis and performance prediction-Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - standalone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

UNIT – V

Solar Passive Architecture: Thermal comfort - bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative

cooling - Radiative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – Energy efficient landscape design - thermal comfort.

TEXT BOOKS:

1. Goswami D.Y., Kreider, J. F. and Francis., "Principles of Solar Engineering', Taylor and Francis, 2000.

2. Chetan Singh Solanki, "Solar Photovoltatics – Fundamentals, Technologies and Applications", PHI Learning Private limited, 2011.

3. Sukhatme S.P.,. Nayak.J.P, 'Solar Energy – Principle of Thermal Storage and collection", Tata McGraw Hill, 2008.

4. Solar Energy International, "Photovoltaic – Design and Installation Manual" – New Society Publishers, 2006.

5. Roger Messenger and Jerry Vnetre, "Photovoltaic Systems Engineering", CRC Press, 2010.

VII Semester	L	T	P	C
	0	0	4	2

CAD/CAM LAB(18ME7L12)

GEOMETRIC MODELING

1. Write program for translation, scaling and rotation.

2. Write program for generating spline Bezier and B-spline.

3. Write program for sweep surfaces and surface of revolution.

4. Blend surfaces using any software.

5. Create wireframe, surface and solid models.

6. Introduction to CNC Machines and G-Code, M-Codes

7. CNC part programming for operations like turning, step turning, taper turning, threading.

8. CNC program for plane milling, drilling operations.

9. Generation of CNC part programming with CAM packages for a given 3D models.

10. Development of APT programming for 2D objects

11. Programming for Robot pick and place and continuous path.

VII Semester	L	T	P	C
	0	0	4	2

MINI PROJECT(18ME7P13)

VIII

SEMESTER

SYLLABUS

VIII Semester	L	T	P	C
	3	0	0	3

MECHANICAL VIBRATIONS(18ME8T01)
PROFESSIONAL ELECTIVE -3

UNIT - I

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

UNIT - II

Forced vibrations of Single Degree Freedom Systems : Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping.

UNIT - III

Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

UNIT - IV

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

Whirling of shafts: Critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping

UNIT - V

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

Text books:

1. Singrasu S. Rao, Mechanical Vibrations, 6/e, Pearson Education, 2018.

2. G.K.Groover, Mechanical Vibrations, 8/e, 2009

Reference books:

1. L. Meirovich, Elements of Vibrations Analysis, Tata McGraw Hill, 1986

2. S. Graham Kelly, Mechanical Vibrations, Tata McGraw Hill, 1996

3. William Thomson, Theory of Vibrations with Applications, 5/e, Pearson, 2008

4. William Weaver, Timeoshenko, and Young, Vibration Problems in Engineering, 5/e, John Wiley, 2013.

VIII Semester

L	T	P	C
3	0	0	3

AUTOMOBILE ENGINEERING(18ME8T02)
PROFESSIONAL ELECTIVE -3

UNIT - I

Introduction to vehicle structure and engine components: Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters - Cooling system - Types - Water pumps - Radiators - Thermostats - Anti-freezing compounds.

UNIT - II

Ignition, fuel supply and emission control system: Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI-Automobile Emissions - Source of formation – Effects on human health and environment - Control techniques - Exhaust Gas Recirculation (EGR) - Catalytic converter - Emission tests and standards (Indian and Europe)

UNIT - III

Transmission system: Clutches - Function - Types - Single plate, Multiple plate and Diaphragm Clutch – Fluid coupling - Gearbox - Manual - Sliding - Constant - Synchromesh - Overdrive – Automatic transmission - Torque converter - Epicyclic and Hydromatic transmission – Continuously variable transmission - Universal joint - Propeller shaft - Hotchkiss drive – Final drive - Rear axle assembly - Types -Differential - Need - Construction – Non-slip differential – Differential locks - Four wheel drive.

UNIT - IV

Steering, suspension and braking system: Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers – Wheels and Tires - Construction - Type and specification - Tire wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS)

UNIT - V

Automobile electrical systems, instrumentation and advances in automobile engineering: Battery-General electrical circuits-Dash board instrumentation - Passenger comfort – Safety and security - HVAC - Seat belts - Air bags - Automotive Electronics - Electronic Control Unit (ECU) - Variable Valve Timing (VVT) - Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP) Traction Control System (TCS) - Global Positioning System (GPS) - X-by-wire - Electric - Hybrid vehicle.

TEXTBOOKS:

1. William.H.Crouse, Automotive Mechanics, 10/e Edition, McGraw-Hill, 2006.
2. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd., 2009.
3. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International, 2004.

REFERENCES:

1. Bosch, Automotive Hand Book, 6/e SAE Publications, 2007.
2. K. Newton and W. Steeds, The motor vehicle, 13/e Butterworth-Heinemann Publishing Ltd.
3. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications.

VIII Semester	L	T	P	C
	3	0	0	3

NON-DESTRUCTIVE TESTING(18ME8T03)
PROFESSIONAL ELECTIVE -3

UNIT I

Introduction to non-destructive testing: Radiographic test**,** Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

UNIT II

Ultrasonic test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

UNIT III

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing**.**

Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing.

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

UNIT IV

Infrared And Thermal Testing: Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –-thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

UNIT V

Industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

TEXT BOOKS:

1. J Prasad, GCK Nair , Non destructive test and evaluation of Materials, Tata mcgraw-Hill Education Publishers, 2008.
2. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag, 1983.
3. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

REFERENCES:

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007.
2.   ASTM Standards, Vol 3.01, Metals and alloys

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VIII Semester	L	T	P	C
	3	0	0	3

EXPERIMENTAL STRESS ANALYSIS(18ME8T04)
PROFESSIONAL ELECTIVE -4

UNIT – I

Introduction: Stress, strain, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, stress functions, mohrs circle for stress strain, Three-dimensional stress strain relations.

UNIT – II

Strain Measurement and Recordings: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits. Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT – III

 Photo elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics
Three dimensional Photo elasticity : Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the sheardifference method in three dimensions, applications of the Frozen-stress method, the scatteredlight method.

UNIT – IV

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.   Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

UNIT – V

Birefringent Coatings Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

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TEXT BOOKS :

1. Theory of Elasticity by Timoshenke and Goodier Jr

2. Experimental stress analysis by Dally and Riley,Mc Graw-Hill

REFERENCES:

1. A treatise on Mathematical theory of Elasticity by LOVE .A.H

2. Photo Elasticity by Frocht 3. Experimental stress analysis, Video course by K.Ramesh / NPTEL

VIII Semester	L	T	P	C
	3	0	0	3

DESIGN FOR MANUFACTURING(18ME8T05)
(PROFESSIONAL ELECTIVE -4)

UNIT - I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNIT - II

Machining processes: Overview of various machining processes-general design rules for machining dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT - III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

UNIT – IV

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT- V

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

TEXT BOOKS:

1.   George E Dieter and Linda Schmidt, Engineering Design, 4th Edition, McGraw Hill (2015)

2.   A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 5th Edition, PHI Learning (2011)

3.   David M Anderson, Design for Manufacturability, CRC Press (2013)

REFERENCES:

1. James G Bralla, Design For Manufacturability Handbook, 2nd Edition, McGraw Hill (2004)

2. Dr.P.C.Sharma, Production Technology, S.Chand & Company (2009)

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VIII Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

REFRIGERATION & AIR-CONDITIONING(18ME8T06)
PROFESSIONAL ELECTIVE -4

UNIT – I

Introduction to Refrigeration: Necessity and applications – unit of refrigeration and C.O.P. – Mechanical refrigeration – types of ideal cycles of refrigeration. Air refrigeration: bell Coleman cycle - open and dense air systems – refrigeration systems used in air crafts and problems.

UNIT – II

Vapour Compression Refrigeration: Working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems.

VCR System Components: Compressors – general classification – comparison – advantages and disadvantages. Condensers – classification – working principles evaporators – classification – working principles expansion devices – types – working principles

UNIT – III

Refrigerants – Desirable properties – classification - refrigerants used – nomenclature – ozone depletion – global warming

Vapor Absorption System: Calculation of maximum COP – description and working of NH_3 – water system and Li Br –water (Two shell & Four shell) System, principle of operation three fluid absorption system, salient features.

Steam Jet Refrigeration System: Working principle and basic components, principle and operation of (i) thermoelectric refrigerator (ii) vortex tube.

UNIT – IV

Introduction to Air Conditioning: Psychometric properties & processes – characterization of sensible and latent heat loads — need for ventilation, consideration of infiltration – load concepts of RSHF, GSHF- problems, concept of ESHF and ADP temperature.

Requirements of human comfort and concept of effective temperature- comfort chart –comfort air conditioning – requirements of industrial air conditioning, air conditioning load calculations.

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UNIT – V

Air Conditioning Systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. Heat pump – heat sources

TEXT BOOKS:

1. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai
2. Refrigeration and Air Conditioning / CP Arora / TMH.

REFERENCES:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration /Dossat / Pearson Education.
3. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH

VIII Semester	L	T	P	C
	3	0	0	3

CONDITION MONITORING AND SIGNAL CONDITIONING(18ME8T07)
PROFESSIONAL ELECTIVE -5

UNIT I

Introduction to condition monitoring: Basic concept, techniques - visual monitoring, temperature monitoring, vibration monitoring, lubricant monitoring, crack monitoring, thickness monitoring, noise and sound monitoring.

UNIT II

Basic signal processing techniques: Probability distribution and density, Fourier analysis, Hilbert Transform, Cepstrum analysis, Digital filtering, Deterministic/random signal separation, Time-frequency analysis

Wavelet transform: Introduction to Wavelets, Continuous Wavelet Transform (CWT), Discrete wavelet transform (DWT), Wavelet Packet Transform (WPT),types of wavelets – Haarwavelets,Shannon wavelets, Meyer wavelets, Daubechies wavelets, Coifmann wavelets and applications of wavelets.

UNIT III

Vibration monitoring, mention bearing and gear faults: Introduction, vibration data collection, techniques, instruments, transducers, selection, measurement location, time domain analysis, frequency domain analysis, time-frequency domain analysis and commonly witnessed machinery faults diagnosed by vibration analysis. Vibration signals from rotating and reciprocating machines – signal classification, signals generated by rotating machines, signals generated by reciprocating machines. Introduction, construction, types of faults, rolling element, rolling element bearing diagnostics and gear diagnostics.

UNIT IV

Other methods in condition monitoring: Wear monitoring and lubricant analysis - sources of contamination, techniques, Spectrometric Oil Analysis Procedure (SOAP) and ferrography, Radiographic test**,** Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

UNIT V

Machine tool wear monitoring techniques and case studies.

TEXTBOOKS:

1. Robert Bond Randall, Vibration-Based Condition Monitoring: Industrial, Aerospace and Automotive applications, John Wiley & Sons Ltd., 2011

2. R.A.Collacot, Mechanical Fault Diagnosis, Chapman and Hall Ltd., 1977.

3.

REFERENCES:

1. John S.Mitchell, Introduction to Machinery Analysis and Monitoring, PennWell Books,1993

2. R.C.Mishra, K.Pathak, Maintenance Engineering and Management, Prentice Hall of India Pvt. Ltd., 2002.

3. Amiya Ranjan Mohanty, Machinery Condition Monitoring: Principles and Practices,CRC press, 2014.

VIII Semester   **L   T   P   C**

                                                 3   0   0   3

COMPUTATIONAL FLUID DYNAMICS(18ME8T08)
PROFESSIONAL ELECTIVE -5

UNIT - I

Elementary Details in Numerical Techniques: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT - II

Applied Numerical Methods: Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, and special forms of the Navier-stokes equations.

UNIT - III

Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation.

Finite difference applications in heat conduction and convention – heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT - IV

Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modelling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - V

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme.

Finite Volume Method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

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TEXT BOOKS:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar/Butter-worth Publishers.

2. Computational fluid dynamics - Basics with applications /John. D. Anderson / McGraw Hill.

REFERENCES:

1. Computational Fluid Flow and Heat Transfer/ Niyogi/Pearson Publications.

2. Fundamentals of Computational Fluid Dynamics /Tapan K. Sengupta / Universities Press.

3. Computational fluid dynamics: An introduction, 3rd edition/John. F. Wendt/ Springer publishers.

VIII Semester	L	T	P	C
	3	0	0	3

ADVANCED MACHINING PROCESSES(18ME8T09)
PROFESSIONAL ELECTIVE -5

UNIT-I

Introduction to advanced machining processes and their classifications- Ultrasonic machining, Magnetic abrasive finishing (MAF) Abrasive jet machining (AJM) Water jet cutting (WJC) and Abrasive water jet machining (AWJM).

UNIT-II

Magnetic abrasive finishing (MAF), Abrasive flow finishing (AFF), Magnetorheological finishing (MRF) and Magnetorheological abrasive flow finishing (MRAFF).

UNIT-III

Electric Discharge Machining and Wire electric discharge machining, Electro Chemical machining, Abrasive and water jet cutting process.

UNIT-IV

Production of Lasers and Laser beam machining (LBM), Power source for plasma and Plasma arc machining (PAM), and Electron Beam Machining (EBM). Advantages and limitations.

UNIT-V

Multi spindle CNC lathe machines and its types with applications. Introduction to part programming, G codes and M codes, programming format and sequence numbers(N). Construction and working of Capstan and Turret lathes. Indexing and bar mechanism in capstan lathe.

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VIII Semester	L	T	P	C
	3	0	0	3

SEMINAR (18ME8S10)

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VIII Semester
                                             L   T   P   C

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PROJECT (18ME8P11)

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VIII Semester
                                               L   T   P   C

Mechanical Engineering