SCSVMV UNIVERSITY

B.E. MECHANICAL ENGINEERING
(FULL TIME)

CURRICULA AND SYLLABUS
FOR
I TO VIII SEMESTERS

(With effect from 2017)

DEPARTMENT OF MECHANICAL ENGINEERING
SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDHYALAYA
SCSVMV UNIVERSITY
(University U/S 3 of UGC Act 1956) Accredited with "B" Grade by NAAC
ENATHUR. KANCHIPURAM – 631 561

Department of Mechanical Engineering

B.E. MECHANICAL ENGINEERING (FULL TIME)

CURRICULUM

(With effect from 2017)

SEMESTER- I

CODE	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
EN1T1	English-I	3	-	-	3	3	40	60	100
MA1T2	Basic Mathematics for Engineering -I	3	1	-	3	3	40	60	100
CH1T3	Engineering Chemistry	3	-	-	3	3	40	60	100
ME1T4	Basic Civil and Mechanical Engineering	4	-	-	3	3	40	60	100
EE1T4	Basic Electrical and Electronics Engineering	4	-	-	3	3	40	60	100
ME1T6	Engineering Graphics (Theory)	2	-	3	3	3	40	60	100
SA1T1	Sanskrit & Indian Culture- I	2	-	-	1	3	100	-	100
CH1P7	Chemistry Laboratory	-	-	3	2	2	40	60	100
ME1P9	Basic Mechanical Workshop	-	-	3	2	2	40	60	100
EE1P9	Basic Electrical Workshop	-	-	3	2	2	40	60	100
	Total	**20**	**1**	**12**	**25**		**460**	**540**	**1000**

SEMESTER- II

CODE	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
EN2T1	English-II	3	-	-	3	3	40	60	100
MA2T2	Basic Mathematics for Engineering -II	3	1	-	3	3	40	60	100
PH2T3	Engineering Physics	3	-	-	3	3	40	60	100
ME2T5	Engineering Mechanics (Statistics & Dynamics)	3	1	-	3	3	40	60	100
CS2T5	Computing Programming	3	-	-	3	3	40	60	100
CH2T6	Environmental Science and Engineering	3	-	-	3	3	40	60	100
SA2T2	Sanskrit & Indian Culture- II	2	-	-	1	3	100	-	100
PH2P7	Physics Laboratory	-	-	3	2	2	40	60	100
CA2P8	Computer Aided Drafting Lab	-	-	3	2	2	40	60	100
CS2P8	Computer Practices Laboratory	-	-	3	2	2	40	60	100
	Total	**21**	**2**	**9**	**25**		**460**	**540**	**1000**

SEMESTER III

CODE	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
MD3T1	Applied Mathematics for Mechanical Engineers - I	3	1	-	3	3	40	60	100
ME3T2	Engineering Thermodynamics	3	-	-	3	3	40	60	100
ME3T3	Material Science & Metallurgy	3	-	-	3	3	40	60	100
CS3T6	Object Oriented Programming Using C++	3	-	-	3	3	40	60	100
ME3T6	Manufacturing Technology-I	3	-	-	3	3	40	60	100
ME3T7	Mechanics of Solids	3	1	-	3	3	40	60	100
SA3T3	Sanskrit & Indian Culture- III	2	-	-	1	3	100	-	100
HR3T1	HR Skills - I	1	1	-	1*	3	40	60	100
ME3P7	Thermal Engineering Lab	-	-	3	2	2	40	60	100
ME3P8	Metallurgy Lab	-	-	3	2	2	40	60	100
CS3P9	OOPS using C++ Lab	-	-	3	2	2	40	60	100
PD3P1	Personality Development – I*	-	-	-	1	-	-	-	-
	Total	**21**	**3**	**9**	**27**		**500**	**600**	**1100**

SEMESTER IV

CODE	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
MD4T1	Applied Mathematics for Mechanical Engineers - II	3	1	-	3	3	40	60	100
ME4T2	Fluid Mechanics & Machinery	3	1	-	3	3	40	60	100
ME4T3	Kinematics of Machines	3	1	-	4	3	40	60	100
ME4T5	Applied Thermodynamics	3	-	-	3	3	40	60	100
ME4T6	Manufacturing Technology – II	3	-	-	3	3	40	60	100
EE4T8	Applied Electrical & Electronics Engineering	3	-	-	3	3	40	60	100
SA4T4	Sanskrit & Indian Culture- IV	2	-	-	1	3	100	-	100
HR4T2	HR Skills - II	1	1	-	1*	3	40	60	100
ME4P7	Fluid Mechanics and Machinery Lab	-	-	3	2	2	40	60	100
ME4P8	Strength of Materials Lab	-	-	3	2	2	40	60	100
EE4P7	Electrical Machines Lab	-	-	3	2	2	40	60	100
	Total	**21**	**4**	**9**	**27**		**500**	**600**	**1100**

SEMESTER V

Code	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
MD5T1	Applied Mathematics for Mechanical Engineers - III	3	1	-	3	3	40	60	100
ME5T2	Heat and Mass Transfer	3	-	-	3	3	40	60	100
ME5T3	Dynamics of Machines	3	1	-	4	3	40	60	100
ME5T4	Metrology And Measurements Systems	3	-	-	3	3	40	60	100
ME5T5	Machine Drawing	2	-	3	3	3	40	60	100
ME5T7	Automobile Engineering	3	-	-	3	3	40	60	100
SA5T5	Sanskrit & Indian Culture – V	2	-	-	1	3	100	-	100
HR5T3	HR Skills - III	1	1	-	1*	3	40	60	100
OL5T1	Open Elective **	2	-	-	2*	3	40	60	100
ME5P7	Mechanical Measurements Lab	-	-	3	2	2	40	60	100
ME5P8	Manufacturing Technology Lab	-	-	3	2	2	40	60	100
EC5P9	Electronics & Microprocessor Lab	-	-	3	2	2	40	60	**100**
	Total	**22**	**3**	**12**	**29**		**540**	**660**	**1200**

As per prevailing list

SEMESTER - VI

Code	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
ME6T1	Gas Dynamics & Jet Propulsion	3	1	-	3	3	40	60	100
ME6T2	Power Plant Engineering	3	-	-	3	3	40	60	100
ME6T3	Design of Machine Elements	3	-	-	3	3	40	60	100
ME6T4	Computer Aided Design	3	1	-	3	3	40	60	100
ME6T7	Mechatronics	3	-	-	3	3	40	60	100
ME6T6	Production and Operation Management	3	-	-	3	3	40	60	100
SA6T6	Sanskrit & Indian Culture – VI	2	-	-	1	3	100	-	100
HR6T4	HR Skills - III	1	1	-	1*	3	40	60	100
ME6P7	Heat Transfer Lab	-	-	3	2	2	40	60	100
ME6P8	Special Machines Lab	-	-	3	2	2	40	60	100
ME6P9	CAD / CAM Lab	-	-	3	2	2	40	60	100
PT6E1	Industrial Training*	-	-	-	1*		100*	-	100*
	Total	**21**	**3**	**9**	**21**		**600**	**600**	**1200**

SEMESTER - VII

Code	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
MD7T1	Operations Research	3	1	-	3	3	40	60	100
ME7T2	Computer Integrated Manufacturing	3	-	-	3	3	40	60	100
ME7T3	Finite Element Analysis	3	-	-	3	3	40	60	100
ME7T4	Design of Transmission Systems	3	1	-	4	3	40	60	100
ME7T5	Fluid power system	3	-	-	3	3	40	60	100
ME7E (1 - 10)	Elective – I	3	-	-	3	3	40	60	100
ME7P8	Mechatronics Lab	-	-	3	2	2	40	60	100
ME7P9	Computer Aided Analysis lab	-	-	3	2	2	40	60	100
ME7Z1	Project Work Phase -I	-	-	4	2	2	40	60	100
SS7P1	Soft Skills**	-	-	-	1**	-	100**	-	100**
	Total	**18**	**2**	**10**	**26**		**460**	**540**	**1000**

SEMESTER VIII

Code	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
ME8T1	Principles of Industrial Management	3	-	-	3	3	40	60	100
ME8T2	Total Quality Management	3	-	-	3	3	40	60	100
ME8E (1 - 9)	Elective – II	3	-	-	3	3	40	60	100
ME8EL (A - I)	Elective – III	3	-	-	3	3	40	60	100
ME8Z2	Project Work Phase -II	-	-	12	6	3	40	60	100
	Total	**12**	**-**	**16**	**18**		**200**	**300**	**500**

L : Lecture Periods;　　**I** : Internal Assessment;

T : Tutorial Periods;　　**E** : External Assessment;

P/D : Practical / Drawing Periods;　　**Tot.** : Total Marks

C : Credits

The Credits for the following programmes has not been considered for CGPA calcalutions:

*Industrial Training   The students have to undergo practical industrial training for 1 to 2 weeks (During Semester holidays) in recognized industrial establishments.

**Soft Skills   The Syllabus and course will be monitored by Placement & Training Cell and the end examination will be practical mode.

*** Open Electives   Students has to take on course from department (only from non-engineering department only). Concerned department faculties will handle the course.

LIST OF ELECTIVE SUBJECTS

VII SEMESTER ELECTIVE – I

Code	Subject
ME7E1	Energy Conservations in Industries
ME7E2	Plant layout and Material handling
ME7E3	Composite Materials
ME7E4	Quality control and Reliability engineering
ME7E5	Casting & Welding processes
ME7E6	Design of Jigs & Fixtures
ME7E7	Design for manufacturing
ME7E8	Turbo Machines
ME7E9	Total Productive Maintenance
ME7E10	Digital Manufacturing

VIII SEMESTER ELECTIVE – II

ME8E1	Design of Heat transfer Equipments
ME8E2	Cryogenic Engineering
ME8E3	Internal Combustion Engines
ME8E4	Product Design & Development
ME8E5	Robotic Technology
ME8E6	Tribology
ME8E7	Nontraditional machining Processes
ME8E8	Theory of Metal Forming
ME8E9	Production of Automotive Components

VIII SEMESTER ELECTIVE – III

ME8EA	Vibration & Noise Control
ME8EB	Refrigeration and Air-Conditioning
ME8EC	Computational Fluid Dynamics
ME8ED	Introduction to Nano Technology
ME8EE	Work Study and Cost Estimation
ME8EF	Entrepreneurship Development
ME8EG	Non Destructive Evaluation
ME8EH	Flexible Manufacturing System
ME8EI	Additive Manufacturing System.

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OPEN ELECTIVE SEMESTER - V

Sl. No.	Sub. Code	Subject Name	Credit
1.	OE5TA	ASTRO - PHYSICS	1
2.	OE5TB	BIOINFORMATICS	1
3.	OE5TC	BUSINESS ADMINISTRATION	1
4.	OE5TD	COMMUNICATION SKILLS	1
5.	OE5TE	FINANCE FOR NON FINANCE MANAGERS	1
6.	OE5TF	FRENCH PRIMER	1
7.	OE5TG	FUEL CELL & BATTERIES	1
8.	OE5TH	GERMAN PRIMER	1
9.	OE5TI	HINDI LITERATURE	1
10.	OE5TJ	HR MANAGEMENT	1
11.	OE5TK	INSTRUMENTAL METHOHS OF CHEMICAL ANALYSIS	1
12.	OE5TL	JAPANESE	1
13.	OE5TM	KEYBOARD	1
14.	OE5TN	LOGISTICS AND SUPPLY CHAIN	1
15.	OE5TO	NANO TECHNOLOGY	1
16.	OE5TP	NUCLEAR AND PARTICLE PHYSICS	1
17.	OE5TQ	PSYCHOLOGY	1
18.	OE5TR	PANINI GRAMMAR	1
19.	OE5TS	STATISTICAL METHODS WITH EXCEL	1
20.	OE5TT	VIOLIN	1
21.	OE5TU	VOCAL MUSIC	1

EN1T1   **ENGLISH - I**   **L T P C**
(For all branches of B.E / B.Tech programmes)   **3 0 0 3**

UNIT I: **Technical Words, Phobia Words and Mania Words** {List Enclosed}

UNIT II: **Functional Grammar**
Parts of Speech, Articles, Prepositions, Verbs, Adverbs, Sentence Analysis,   Tenses, Basic Patterns, Prefixes and Suffixes, Syllabification and Spelling

UNIT III: **Essays**
1. Spoken English and Broken English – G.B. Shaw
2. Arguing - Robert Lynd
3. The Verger - Somerset Maugham
4. The Beauty Industry – Aldous Huxley

UNIT IV: Paragraph writing relating to Charts, Tables and graphs and Acronyms.

UNIT V: Dialogue Writing, Advertisement.

Examinations:
i. There will be Two Internal Assessments.
ii. The written examination will be for 100 marks and this will be converted to 60.
iii. The passing minimum for Internal Assessment is 20/40 and 50/100 for core examinations. A candidate has to secure 50% taking together the marks secured both in the Internal and core examination.

Pattern of Question Paper:
1. Part A   : 20 Questions - Objective type from Units I, II and III only (20x1=20 Marks)
2. Part B   : Five Questions of <u>Either or</u> type – one from each unit (5x6=30 Marks)
3. Part C   : Five Questions of <u>Either or</u> type – One from each unit (5x10=50 Marks)

1.Vocabulary

TechnicalWords:	Mania - Words:
Collateral	1. Bibilomania
Amalgamation	2. Dipsomania
Permeability	3. Egomania
Volatile	4. Kleptomania
Defy	5. Megalomania
Paradox	6. Pyromania
Plague	
Douse	
Fantasy	
Malevolent	**Phobia - Words**
Benevolent	1. Acrophobia
Myth	2. Gynophobia
Crux	3. Hydrophobia
Vagaries	4. Claustrophobia
Ballast	5. Ergophobia
Sanctuary	6. Zoophobia
Repository	7.Agoraphobia
Panorama	8. Arachnophobia
Heritage	9. Triskaidekaphobia
Innovation	10. Xenophobia
Nuances	
Vicissitudes	
Nodal	
Viable	
Deluge	
Amphibian	
Ornithologist	
Pulmonary	
Retard	
Impediment	
Rapport	

BASIC MATHEMATICS FOR ENGINEERING - I **L T P C**

(For all branches of B.E / B.Tech programmes) **3 1 0 3**

UNIT I
NUMERICAL SOLUTION OF ALGEBRAIC, TRANSCENDENTAL EQUATION

Solution of algebraic and transcendental equations - Bisection method – Method of successive approximation-Method of false position (Regula-Falsi Method) - Newton-Raphson method-Honer's method-Secant method. Matlab applications.

UNIT II
EIGEN VALUES, EIGEN VECTORS

Rank of matrix – Elementary transformation – Elementary matrices-solution of linear system of equations-Cramer's rule-Matrix inversion method-Consistency of linear system of equations; Linear Transformations – Linear dependence of vectors – Eigen values and Eigen vectors – Properties of Eigenvalues – Cayley Hamilton theorem (without proof). Matlab applications

UNIT III
DIFFERENTIAL CALCULUS AND DIFFERENT IAL EQUATION

Function of two or more variables – Partial derivatives – Total derivative – Taylor's expansion – Maxima and Minima of functions of two variables – Jacobians –Homogenous functions - Euler's theorem for homogeneous function Operator D – Rules for finding Complementary function – Inverse operator – Rules for finding particular Integral – Working procedure to solve the equation. - Method of undetermined coefficients

UNIT-IV

LINEAR DIFFERENTIAL EQUATIONS

Method of variation of parameters- Equations reducible to linear equations with constant coefficients: Cauchy's homogeneous linear equation , Legendre's linear equation - Linear dependence of solutions - Simultaneous linear equations with constant coefficients

UNIT V
VECTOR DIFFERENTIATION

Differentiation of vectors - Curves in space - Velocity and acceleration - Scalar and vector point functions –vector operator Del- Del applied to scalar point functions : Gradient - Del applied to vector point functions : Divergence and curl - Physical interpretation of divergence and curl-irrotational and solenoidal vectors – Del applied twice to point functions - Del applied to products of point functions-Conservative vector field.

Note: Questions are to be set on problem solving and not on the theoretical aspects.

PRESCRIBED TEXT BOOK:
Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.
REFERENCES

1. Alan Jeffrey, Advanced Engineering Mathematics, Academic Press
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company.

CH1T3　　　　　　　**ENGINEERING CHEMISTRY**　　　　**L T P C**

　　　　　　　(For all branches of B.E / B.Tech programmes)　　**3 1 0 3**

Unit-I: CHEMICAL THERMODYNAMICS

Introduction - Limitations of first law – different statements of second law (Clausius and Kelvin) – Entropy – entropy change for a reversible process – entropy change for an isothermal expansion of an ideal gas – problems – Free energy - Work function – Gibbs Helmholtz equation and its applications - Van't hoff isotherm and isochore – applications.

Unit-II: CHEMICAL KINETICS AND CATALYSIS

Kinetics of second order reactions –half life period – saponification of ester – kinetics of opposing, parallel reactions and its examples - effect of temperature on reaction rate – theory of absolute reaction rate. Classification and characteristics of catalysts – autocatalysis – steady state principle - enzyme catalysis – Michaelis menton equation (derivation) – types of acid base catalysis

Unit-III: THERMAL AND SPECTROSCOPIC TECHNIQUES

Thermogravimetry (TGA) – schematic and block diagram – characteristics of thermo-balance design – methods expressing TG results – applications in qualitative analysis, composition of alloys and mixtures, study of polymers. Differential thermal analysis (DTA) - schematic and block diagram – representation of DTA data – qualitative application (calcium oxalate monohydrate only). Electromagnetic spectrum – Beer Lambert's law (Derivation) – principle, theory, instrumentation and simple applications of: Flame photometry – UV-visible spectroscopy - IR spectroscopy.

Unit IV: CORROSION - THEORY & PROTECTION

Standard electrode potential - electrochemical series - Electrochemical cells – principles of corrosion - chemical and electrochemical corrosion - galvanic corrosion - differential aeration corrosion - stress corrosion – factors influencing corrosion – corrosion control - cathodic protection and sacrificial anode – corrosion inhibitors - protective coatings - constituents, functions and uses of paints and varnishes.

Unit-V: POLYMERS AND NANOMATERIALS

Polymer Chemistry: Monomers – functionality – polymers - degree of polymerization – effect of polymer structure on properties – addition, condensation, co-polymerization - mechanism of addition polymerization (free radical polymerization only). Nanomaterials: Introduction - synthesis of nano materials by physical and chemical methods - ball milling - chemical vapour deposition -sol-gel method - applications of nano materials.

Text Book
1. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpat Rai Publishing Co Pvt. Ltd., New Delhi, 2008.

Reference Books
1. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and Madan S. Pathania, Shoban Lal Nagin Chand & Co., Jalandhar, 2000.
2. Physical Chemistry for Engineers, P.C. Jain and Renuka Jain, Dhanpat Rai & sons, New Delhi, 2001.
3. Applied Chemistry, K. Sivakumar, Anuradha Publications, Chennai, 2009.
4. Chemistry in Engineering & Technology, J.C. Kuriacose and J. Rajaram, Vol. 1, Tata McGraw-Hill, New Delhi, 1996.

ME1T4   **BASIC CIVIL AND MECHANICAL ENGINEERING**   **L T P C**
              (For all branches of B.E / B.Tech programmes)   **4 0 0 3**

PART A - CIVIL ENGINEERING

UNIT - I

BUILDING MATERIALS Construction Materials and foundation Properties and uses of construction materials such as stone, bricks, cement, concrete, steel.

BUILDING COMPONENTS Selection of site - simple foundations such as well footing-isolated footing. Combined footing. Pile foundation - foundations of machinery. Superstructure Brick and stone masonry - beams. Columns and lintel RCC roofing - simple steel roof trusses and AC roofing - Flooring types such as granolithic. Concrete, mosaic, tile, terrazzo, marble etc., - plastering.

VALUATION Valuation by plinth area method -simple problems.

UNIT - II

MECHANICS Units - Simple stresses and stains for uniform section - Moduli of elasticity - Factory of safety - centre of gravity and moment of inertia - simple problems.

DAMS Selection of site - Brief idea of different types of dams - their purpose.

BRIDGES Components of bridge - classification - slab bridge I - bean bridge.

UNIT - III

SURVEYING - Different types of surveying - chain survey - calculation of area by Simpson's rule and trapezoidal rule - compass - conversion on bearings - simple leveling - reduction of levels - simple problems.

ROAD Classification - brief description of earthen road. Water bound macadam. Bituminous. Concrete roads - traffic signs and signals.

ENVIONMENTAL ENGINEERING Protected water supply - sewage treatment - septic tanks.

PART B - MECHANICAL ENGINEERING

UNIT - I

BOILERS Classification - Principles of Low pressure steam generators – simple Vertical Boiler, Cochran Boiler, Locomotive Boiler, Lancasier Boiler, Bop-cock Wilcox Boiler

POWER PLANTS Layout of Steam, Gas Turbine, Diesel, Nuclear and Hydropower Plants.

NEW SOURCES OF ENERGY   Study of different types of alternative energy sources - Solar, Wind, Wave, Tidal and Geo - thermal.

UNIT - II

INTERNAL COMBUSTION ENGINES- Working principles of Petrol and Diesel Engines - Two stroke and Four stroke cycles-Function of main components - single jet carburetion - ignition. Cooling and lubrication systems - fuel pump and injector.

METAL CASTING PROCESS   Patterns - Types of patterns - Pattern materials - pattern allowances - Molding sand - Properties of molding sand - types of molding - preparation of Green sand mould for casting - melting of cast iron in cupola furnace only - casting defects.

UNIT - III

METAL FORMING PROCESS- Principles of Forging. Rolling, Drawing and Extrusion.

METAL JOINING PROCESS Principles of welding - fundamental of Arc welding. Gas welding and gas cutting - Brazing and soldering.

METAL MACHINING PROCESS Types of lathes - Main components and the functions of a centre lathe - operations - cutting tools - Drilling machines.

TOTAL : 45 PERIODS

TEXT BOOKS

    1   Basic Civil Engineering- V. Ramesh Babu, Anuradha Agencies, Kumbakonam.

    2   Basic Civil Engineering- K.V. Natarajan, Madras.

    3   Basic Mechanical Engineering- K.Venugopal, Anuradha gencies,Kumbakonam.

REFERENCE BOOKS

    1   Basic Civil Engineering - N. Arunachalam, Pratheeba Pub. Coimbatore.

    2   Basic Civil and Mechanical Engineering - G. Shanmugam and M.S. Palanichamy, Tata McGraw Hill Publishing Co., 1993.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L T P C

(For all branches of B.E / B.Tech programmes)

4 0 0 3

UNIT -I
ELECTRICITY AND MAGNETISM:
Electric current –Ohms law –Temperature coefficient of resistance-Kirchhoff's laws

Electromagnetic induction: Relation between magnetism and electricity –Production of induced E.M.F and current –Faraday's laws of electromagnetic induction –Direction of induced E.M.F and current-Fleming's Right rule-Lenz's law-Induced E.M.F –Dynamically induced E.M.F-Statically induced E.M.F-Self inductance-Coefficient of self inductance (L)-Mutual inductance –Coefficient of mutual inductance(M) -Coefficient of magnetic coupling-Inductances in series.

UNIT -II
COMPLEX ALGEBRA AND A.C CIRCUITS:
Mathematical representation of vectors –Symbolic notation –Significance of operator j – Conjugate complex numbers –Trigonometrical form of vector representation –Exponential form of vector representation –Polar form of representation –Addition and subtraction of complex quantities –Multiplication and division of complex quantities –Powers and roots of vectors –Complex algebra applied to series circuits –Complex algebra applied to parallel circuits –Series –Parallel circuits.

UNIT -III
THREE PHASE CIRCUITS:
Generation of three phase voltages –Phase sequence –Numbering of phases-Inter connection of three phases –Star or wye(Y) connections –Voltages and currents in Y-connection –Neutral current in unbalanced star-connection –Delta(Δ) or mesh connection –Balanced Y/Δ and ΔY conversions –Comparison: star and delta connections –Comparison between single and three phase supply system -Power factor improvement –Power factor correction equipment –Power measurement in three phase circuits –Three wattmeter method –Two wattmeter method – (Balanced and unbalanced load) –Two wattmeter method –Balanced load –Reactive power – One wattmeter method.

UNIT -IV
DIGITAL ELECTRONICS: Binary number system –Logic gates –Boolean algebra –Half and Full adders –Flip –Flops –Registers and counters –A/D and D/A conversion – Basics only, Junction diodes basic types, transistors basic types.

UNIT –V

FUNDAMENTALS OF COMMUNICATION ENGINEERING:
Types of signals: Analog and digital signals –Modulation and demodulation: Principles of amplitude and frequency modulation. Communication systems: Radio, T.V, Fax, Microwave, Satellite and Optical fiber (Block diagram approach only).

TEXT BOOKS:
1. B.L.THERAJA-Fundamentals of Electrical Engineering and Electronics -2012 Edition, S.Chand Publishers.
2. T.L.THYGARAJAN-Fundamentals of Electrical Engineering and Electronics - 2012 Edition, Scitech Publishers.
3. V.K.MEHTA – Principle of Electronics - 2012 Edition S.Chand Publishers.

ME1T6   **ENGINEERING GRAPHICS (THEORY)**   **L T P C**
              (For all branches of B.E / B.Tech programmes)   **2 0 3 3**

OBJECTIVES

• To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

UNIT – 0 (Not included for the examination)   **3**
BASICS OF DRAWING
Use of Drawing instruments - BIS conventions and specifications - size layout and folding of drawings sheets - lettering and dimensioning - studying the method of drawing ellipse, Parabola and Cycloids.
VISUALIZATION CONCEPTS AND FREE HAND SKETCHING:
Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT – I   **9**
PROJECTION OF POINTS
Introduction to orthographic projections - Projection of points
PROJECTION OF LINES
Projection of straight lines in the first quadrant, lines parallel to both planes - inclined to one plane and parallel to other - inclined to both planes.

UNIT – II   **9**
PROJECTION OF SOLIDS
Projection of Simple solids like prism, pyramid, cylinder, cone and sphere - Auxiliary projections.

UNIT – III   **9**
SECTION OF SOLIDS
Section of solids like prism, pyramid, cylinder, cone and sphere in simple position - True shape of sections for the above.
DEVELOPMENT OF SURFACES
Surfaces like - Prism, Pyramid, Cylinder, Cone and Cut solids.

UNIT – IV   **9**
ORTHOGRAPHIC PROJECTION
Conversion of pictorial views to orthographic views of simple machine members.
INTERPENETRATION OF SOLIDS
Interpenetration of solids - Cylinder and cylinder, cone and cylinder

UNIT - V   **9**
ISOMETRIC PROJECTIONS
Isometric Projections of solids.
PERSPECTIVE PROJECTIONS
Perspective projections of solids.

UNIT - VI (Not for examination)   **3**
COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)
Introduction to drafting packages and demonstration of their use.

TOTAL : 45+6 PERIODS

TEXT BOOKS

1   Engineering Drawing - K. Venugopal, Wiley Eastern Ltd., 1922.
2   A text book of Engineering Drawing - K.V. Natarajan.

REFERENCE BOOKS

1   Elementary Engineering Drawing (First Angle Projection) N.D. Bhatt, Charotar publishing Co., Anand.
2   Engineering Drawing - S.M. Sekkilar & S. Tamarai Selvi, Anuradha Agencies, Kumbakonam.
3   Engineering Drawing and Graphics - Prof. K.Venkataraman.

Special points applicable to University Examinations on Engineering Graphics:

1   There will be five questions, each of either or type covering all units of the syllabus.
2   All questions will carry equal marks of 20 each making a total of 100.
3   The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4   The examination will be conducted in appropriate sessions on the same day

Samstrita siksha

Unit I

1.Vowels, 2. Consonants, 3. Words starting with vowels, 4. Words begin with "ka" to "gna"5. Words begin with "ta" to "na" 6. Words starting with "pa" to "ha"

Unit II

1. Words begin with "ka" to "gha" with the combination of vowels in order.
2. Words begin with "ca" to "jha" with the combination of vowels in order.
3. Words begin with "ta" to "Na" with the combination of vowels in order.
4. Words begin with "tha" to "na" with the combination of vowels in order.
5. Words begin with "pa" to "ma" with the combination of vowels in order.
6. Words with combined letters.

Unit III

        Samstrita Siksha Part II   Lessons 1,2,3,4

Unit IV

        Samstrita Siksha Part II   Lessons 5,6,7,8

Unit V

        Samstrita Siksha Part II   Lessons 9,10,11,12

REFERENCE BOOKS

1   1.Joshi, K, 1992 (rp). The Veda and Indian Culture. Rashtriya Veda Vidya Pratishthana, NewDelhi.
2   2. Majumdar, R.C. 1994 (rp) Ancient India, Motilal Banarsidas Publishers, New Delhi. 3.Patel, I.S, (ed.) 1984 Science and the Vedas, Bombay.

| CH1P7 | CHEMISTRY LABORATORY | **L T P C** |
| | **(For all branches of B.E / B.Tech programmes)** | **0 0 3 2** |

LIST OF EXPERIMENTS (ANY 6)

1. Conductometric Acid- Base Titration
2. Potentiometric Acid-Base Titration
3. Potentiometric Redox Titration
4. Estimation of percentage of sodium carbonate in washing soda
5. Conductometric precipitation titration
6. Estimation of Total Hardness of water
7. Phase-rule-simple Eutectic system (Two-component system)
8. Verification of Beer-Lambert's law (By Spectrophotometry)
9. Determination of Single Electrode potential of Copper Electrode
10. Kinetics of Reaction between

TOTAL : 45 PERIODS

| EE1P9 | **BASIC ELECTRICAL WORKSHOP** | **L T P C** |
| | | **0 0 3 2** |

LIST OF EXPERIMENTS:

1. House Wiring – Series, Parallel, 3 Pin Plug Socket, etc.
2. Staircase Wiring.
3. Tube Light / CFLWiring.
4. Circuit Tester.
5. Single Phase & Three Phase Energy meters.
6. To Study the use of Megger.
7. To Study The Applications Of CRO.
8. Logic Gate Trainer.
9. Soldering Practice for fabrication of DC power Supply.
10. Different faults in Domestic Electrical equipments.
11. Power wiring for three phase induction motor.
12. Power wiring for single phase induction motor.
13. To Study the use of Multimeter, Tong- tester.

TOTAL : 45 PERIODS

ME1P9	**BASIC MECHANICAL WORKSHOP**	**L T P C**
	(For all branches of B.E / B.Tech programmes)	**0 0 3 2**

CARPENTRY

Names and uses of tools used in carpentry - Handling of the tools. Practice in marking, sawing, planning and chiseling to size. Making simple joints such a half lap, mortises and Tenon joints.

FITTING

Name and uses of tools like files, chisels, hammer, tri square, calipers, hacksaw, etc., and handling of these tools. Practice in marking, chipping, fitting to size and drilling marking of simple mating, profiles such as Vee , Square.

WELDING

Study of Arc & Gas Welding, Tools and Equipments – Simple welding exercises – Butt welding and Lap Welding.

TURNING

Study of Centre Lathe, Accessories and tools – Simple turning exercises – Facing and Step turning - use of measuring Instruments for lathe work.

DRILLING

Study of drilling machines – Drills, Taps, and reamers – Demonstration of Drilling and Tapping operations.

Demonstration of the following (not included for the examination)
1. Preparation of green sand mould.
2. Study of tool in smithy shop and making a square section from circular section.
3. Gas welding and cutting.
4. Brazing and soldering.
5. Sheet Metal Work

TOTAL : 45 PERIODS

SEMESTER - II

EN2T1   **ENGLISH - II**   **L T P C**
               (For all branches of B.E / B.Tech programmes)   **3 0 0 3**

UNIT I :   **Words for Social Interaction** {List Enclosed}

UNIT II: **Functional Grammar**
Noun Group, Verbal Group, Modal Verbs, Conditionals, Connectives, Passivity, Gerund and Infinitives, Reported Speech, Synonyms and Antonyms, Concord and Error detection.

UNIT III: **Essays**
1. On Habits – A.G. Gardiner
2. How to Make a Speech - Edgar Baker
3. Springtime - O.Henry
4. Dangers of Drug Abuse – Hardin Jones

UNIT IV: Letter Writing, Report Writing, Essay Writing (Essays on Sports Social Issues, Science and Technology and Proverb Expansions) and Comprehension.

UNIT V: British English and American English With Emphasis on Vocabulary and Spelling (From Reader's Digest's Publication)

Books for Reference:
1. Bikaram K. Das : Functional Grammar and Spoken and Written communication in English
(Orient Blackswan Chennai - 600002)
2. T. M.Farhathullah : English Practice Book (Emerald Publishers)
The prescribed Essays will be compiled and edited by the staff of the Department of English.

Examinations:
i. There will be 2 Internal Assessments.
ii. The Written examination will be for 100 marks and this will be converted to 60. A candidate has to secure 50%, taking together the marks secured both in the Internal and Core Examination.

iii. Pattern of Question Paper:

1. Part A: 20 Questions - Objective type from Units I, II and III only (20x1=20 Marks)
2. Part B: Five Questions of Either or type – one from each unit (5x6=30 Marks)
3. Part C: Five Questions of Either or type – One from each unit (5x10=50 Marks)

Words for Social Interaction:

1. Euthanasia
2. Bier
3. Charlatan
4. Cynosure
5. dejà vu
6. Myopia
7. Epicentre
8. Oedipus complex
9. Electra complex
10. Halitosis
11. Imbroglio
12. Impasse
13. Paranoia
14. Id
15. Ego
16. Super Ego
17. Psychopath
18. Guarantee
19. Warranty
20. Neologism
21. Nepotism
22. Oligarchy
23. Anarchy
24. Utopia
25. Dystopia
26. Philanthropy
27. Plagiarism
28. Euphemism
29. Autarky
30. White Paper
31. Theocracy
32. Ombudsman
33. Anthology
34. Dialectic
35. Asphyxiation
36. Doggy bag
37. Somnambulism
38. Dermatitis
39. Biopsy
40. Anti-biotic
41. Vendetta
42. Virago
43. Prefixes – pseudo, quasi, bi, mono, poly, semi, retro, circum, intro, intra and inter

MA2T2 **BASIC MATHEMATICS FOR ENGINEERING - II** **L T P C**

(For all branches of B.E / B.Tech programmes) **3 1 0 3**

UNIT I
NUMERICAL SOLUTION OF SIMULTANEOUS EQUATIONS

Solution of linear simultaneous equations - Direct methods of solution: Gauss elimination method , Inversion of a matrix using Gauss –Elimination method- Gauss – Jordan method – Method of Factorization-Crout's method, Iterative methods of solution : Jacobi's method , Gauss – Seidel method.

UNIT II

ORTHOGONAL REDUCTION

Orthogonal transformation-Reduction to diagonal form – Similarity matrices – Powers of a matrix - Reduction of quadratic form to canonical form – Nature of a quadratic form – Hermitian, Skew Hermitian and Unitary matrices – Outline of applications of Eigen values and Eigen vectors in engineering

UNIT III

INTEGRAL CALCULUS AND ITS APPLICATIONS

Reduction formulae – reduction formulae[without proof] and Bernoulli's formula.Definite integrals , length of the curve. Double integrals - Change of order of integration - Double integrals in polar coordinates - Areas enclosed by plane curves - Triple integrals – Volume as double integrals - Volume as triple integral

UNIT IV

BETA AND GAMMA FUNCTIONS

Change of variables in double integrals and Triple integrals – Area of a curved surface Beta function - Gamma function –Reduction formula for $\Gamma(n)$ - Relation between Beta and Gamma functions – Outline of applications of multiple integrals

UNIT V

VECTOR INTEGRATION

Integration of vectors - Line integral-circulation-work - Surface integral - Green's theorem in the plane (without proof) - Stoke's theorem (without proof) - Volume integral - Gauss divergence theorem (without proof) - Irrotational fields – Outline of applications of vector calculus in engineering.

Note: Questions are to be set on problem solving and not on the theoretical aspects.

PRESCRIBED TEXT BOOK:

Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.

REFERENCES

1. Alan Jeffrey, Advanced Engineering Mathematics, Academic Press
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company

ENGINEERING PHYSICS

(For all branches of B.E / B.Tech programmes)

L T P C
3 0 0 3

UNIT I – PROPERTIES OF MATTER (9 Hours)

Elasticity

Stress – Strain – Hooke's law – Elastic Behavior of Material – Factors affecting elasticity – Young's modulus by cantilever depression – Non-uniform bending - Application -I-shaped girders. Torsional Pendulum – Couple per unit twist of a wire-Time period-Application-Determination of Rigidity Modulus.

UNIT II – TECHNICAL ACOUSTICS (9 Hours)

Acoustics

Acoustics of buildings – Reverberation- Weber Fechner law- Factors affecting acoustics of a building and remedies – Noise Pollution – Noise control in machines –Sabine's formula for standard reverberation time- Absorption coefficient.

Ultrasonics

Generation – Piezoelectric method – Magnetostriction method – Application of Ultrasonics in industries – NDT.

UNIT III – PHOTONICS (9 Hours)

LASER

Properties- Population inversion- Einstein's theory of stimulated emission of radiation - Different types of Lasers – Nd:YAG laser, CO_2 laser – Application of Lasers in holography.

Fiber Optics

Types of Optical Fibers (material, mode, index) – Fiber losses – acceptance angle – Numerical aperture – applications in engineering (communication).

UNIT IV – CRYSTAL PHYSICS (9 Hours)

Crystalline and amorphous solids – lattice and unit cell – seven crystal systems and Bravais lattices - crystal planes and directions- Miller indices-Expression for interplanar distance – Atomic radius, Coordination number and packing factor for simple structures: SCC, BCC and FCC.

UNIT V – PHYSICS OF MATERIALS (9 Hours)

Dielectric materials
Definition – Dielectric Breakdown – Dielectric loss – Internal field – Claussius Mossotti relation.
Superconducting materials
Introduction – Meissner effect – Type I & Type II superconductors – BCS theory-Applications.
Nanomaterials
Introduction – Synthesis of nano materials – Top down and Bottom up approach- Ball milling- PVD method- Applications.

TEXT BOOKS

1. Applied Physics for Engineers – K.Venkatramanan, R.Raja, M.Sundarrajan (Scitech)
2. Applied Engineering Physics – Rajendran & Marikani (Tata McGraw Hill)
3. Modern Engineering Physics – R.K.Gaur & S.L.Gupta, Dhanpat Rai publications.
4. Modern Engineering Physics – A.S.Vasudeva – S.Chand & Company Ltd.
5. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications.
6. Engineering Physics I & II – G.Senthilkumar, VRB publications

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REFERENCE BOOKS

1. Properties of Matter - D.S.Mathur (Unit I)
2. Sound   - Brijilal & Subramanian (Unit II)
3. Engineering Physics - M.N.Avadhanulu (Unit III)
4. Fiber Optics   - R.Agarwal (Unit III)
5. Solid state Physics – C.Kittal (Unit IV)
6. Modern Physics   - R.Murugesan (Unit IV, V)
7. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York.

ME2T5   **ENGINEERING MECHANICS**   **L T P C**
              (STASTICS & DYNAMICS)

                                                  3 1 0 3

UNIT- I   **9**
BASICS AND STATICS OF PARTICLES - Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT -II   **9**
EQUILIBRIUM OF RIGID BODIES Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT - III   **9**
PROPERTIES OF SURFACES AND SOLIDS - Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT -IV   **9**
DYNAMICS OF PARTICLES - Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT- V   **9**
FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS - Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction-Ladder friction-Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of bodies.

                                                  TOTAL : 45 PERIODS

TEXT BOOK

1   Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers",   Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 2006 8th edition

REFERENCES

1   Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2007)3rd Edition.
2   Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3   Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4   Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd.,(2008).
5   Ashok Gupta, "Interactive Engineering Mechanics – Statics – A   Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).
6   Kumar, "Engineering Mechanics" Tata McGraw-hill, 2007, 3rd Edition
7   S.S. Bhaikatti, " Engineering Mechanics", New Age International Publishers, 2006
8   U.G. Sindhal, " Engineering Mechanics", Galgotia Publishers, 2004.
9   Meriam & Kraige, " Engineering Mechanics", Vol 2, 5th Edition, Wiley Student edition,
10 V. S. Mokhshi, " Engineering Mechanics", Tata McGraw-Hill, 1999.
11 R. S. Kurmi, " Engineering Mechanics", S. Chand Publishers, 2004.

CS2T5	COMPUTING PROGRAMMING	L T P C
		4 0 0 3

UNIT- IINTRODUCTION 9

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT- II   C PROGRAMMING BASICS 9

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT- III   ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String-String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT- IV   FUNCTIONS AND POINTERS 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT- V   STRUCTURES AND UNIONS 9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL: 45 PERIODS

TEXTBOOKS:

1   Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
2   Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3   Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

REFERENCES:

1   Kernighan,B.W and Ritchie,D.M, "The C Programming language",Second Edition, Pearson Education, 2006
2   Byron S Gottfried, " Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
3   R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

CH2T6   **ENVIRONMENTAL SCIENCE AND ENGINEERING**   **L T P C**

(For all branches of B.E / B.Tech programmes)   **3 0 0 3**

Unit - 1: Introduction to environment and environmental studies

Introduction to environment – components – nature of environment - need of awareness – reasons for environmental problems – anthropocentric and eco centric views.

Environmental studies - multidisciplinary nature – scope and aim – sustainable development- principles – RRR concept-Indian environmental movements – environmental calendar.

Unit – 2: Ecosystem and Biodiversity

Ecosystem – structure – functions – simplified ecosystem models (food chain and food webs and their types,energy flow) - forest – grassland – pond –ecosystems – ecological succession - ecological pyramids – Bio-geochemical cycles of water – oxygen-carbon-phosphorous and sulphur.

Biodiversity – definition – types – species – genetic and ecosystem diversities- values of biodiversity – threats to biodiversity – conservation of biodiversity – endemism – biodiversity hotspots – Indian biodiversity– endemic species of India – IUCN lists -red-green and blue data books.

Unit – 3: Natural resources

Natural resources – definition – types – forest resources – uses –deforestation- reasons - effects –water resources – dams – effects of dams - food resources – modern agriculture– ill effects -energy resources- types – hydel –nuclear – solar –wind and biomass energy - world scenario – Indian scenario.

Population and environment – reasons for over exploitation of resources – population – demography – population curves – population explosion – effects – consumerism – effects – urbanization – reasons and effects- role of an individual.

Unit – 4: Environmental Pollution

Pollution – definition – types – air pollution – causes and effects – effects of CO_2 – CO – NOx –SOx – particulates – control of air pollution – water pollution – causes – effects – remedies – soil pollution – solid waste management – e waste – ill effects of e-waste – proper recycling- Noise pollution – reasons – effects – control – nuclear pollution – cases – effects and control – thermal pollution causes – effects and remedies.

Legal provisions for protecting environment – article 48 A – 51 A (g) – Environment act 1986 – Air act 1981 – Water act 1974 – wild life protection act – Forest act 1980- problems in implementation–reasons.

Unit – 5: Social issues and environmental ethics

Present environmental scenario – green house effect – climate change – The Kyoto Protocol – ozone layer depletion-The Montreal Protocol - acid rain – causes – effects - disparity among the nations – The Copenhagen UNFCCC summit – carbon currency- virtual water- genetically modified organisms, Disaster management.

Environmental ethics – introduction – people getting affected - resettlement and rehabilitation – issues involved –Sardhar Sarovar project – Tawa Matsya sang - Melting icebergs of Arctic.

Text Book

Anubha Kaushik and C.P. Kaushik, "Prospects of Environmental Science", New Age International publishers, 2013.

Reference books

1. Environmental Studies, N. Nandini, N. Sunith a and Sucharita Tandon, Sapna Book House, 2007.

2. Text book of Environmental Science, Ragavan Nambiar, Scitech Publications, 2009.

3. Text book of Environmental Chemistry and Pollution Control, S.S.Dara, S.Chand and Co., 2002.

4. Environmental Chemistry, Colin Baird, W.H.Freeman and company, New York,1999.

5. Environmental Chemistry, Gary W. VanLoon and Stephen J.Duffy, Oxford University Press, 2000.

6. New Trends in Green Chemistry, V.K. Ahluwalia and M. Kidwai, Anamaya Publishers, 2006.

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SA2T2	SANSKRIT & INDIAN CULTURE - II	L T P C
	(For all branches of B.E / B.Tech programmes)	2 0 0 1

Indian Culture

Unit - I
Introduction - origin of Man and evolution of Culture and Civilization; Significance of Indian Culture, Chronology of Indian Culture; Origin and spread; General feature of Indian Culture; Unity in Diversity.

Unit- II
How to reconstruct the past; Significance and necessity to reconstruct the past; major sources to reconstruct the Culture.
Archaeological sources -- Important excavated sites and material remains;
Literary sources - Chronology of Indian Literature; Early indian Literature in Sanskrit and other Languages;
Foreign Writers and travelers report.

Unit- III
Early cultural centers in India - from Sindh to Kaveri, Main features and important centers.

Unit - IV
Early Indian Education - Gurukulas and Guru -Sishya parampara, Evaluation of script and languages; Important early scripts and writing materials; Important early educational centres(Ghattikas).

Unit - V
Scientific thoughts of early Indian sages; Concept of Yajna and worship, Important manuscripts - Amsu Bhodhini, Yantrasarvasva, Krisiparasara, Sulvasutra, Lohatantfra, etc.,

REFERENCE BOOKS
1   1.Joshi, K, 1992 (rp). The Veda and Indian Culture. Rashtriya Veda Vidya Pratishthana, NewDelhi.
2   2. Majumdar, R.C. 1994 (rp) Ancient India, Motilal Banarsidas Publishers, New Delhi. 3.Patel, I.S, (ed.) 1984 Science and the Vedas, Bombay.

PH2P7 : ENGINEERING PHYSICS PRACTICAL

List of Experiments

Any 6:

1. Determination of Acceleration due to gravity 'g' using Compound Pendulum.

2. Determination of Rigidity Modulus & Moment of Inertia using Torsional Pendulum

3. Determination of Young's Modulus using Cantilever Depression.

4. Determination of Wavelength of Laser light using transmission grating.

5. Determination of Coefficient of Thermal conductivity using Lee's Disc method.

6. Determination of Emissivity of a Surface using Spherical calorimeter.

7. Determination of Refractive index of material of prism using Spectrometer i-d curve.

8. Determination of Radius of curvature of the given lens using Newton's rings.

9. Study of Forward and reverse characteristics of a PN junction diode.

10. To study the characteristics of a NPN / PNP transistor in CE mode.

11. Basic logic gates – Verification of truth tables (OR, AND, NOT, NAND, NOR).

12. NAND & NOR as Universal building blocks – Verification of Demorgan's theorem.

13. Determination of Velocity of sound waves in liquid using Ultrasonic interferometer.

14. Measurement of Attenuation and numerical aperture using optical fiber.

15. Determination of size of the particle – Laser source.

16. Determination of conductivity of solids using Four probe method.

17. Determination of Ultrasonic velocity in solids- Ultrasonic technique.

REFERENCE BOOKS FOR PHYSICS PRACTICALS

1. Practical Physics – Ouseph and Rangarajan.

2. Engineering practical Physics – K.Srinivasa.

3. Engineering practical Physics – M.N.Avadhanulu.

4. Experimental Physics for Engineers– Venkatramanan, Sundarrajan, Raja

CA2P8	**COMPUTER AIDED DRAFTING LAB**	**L T P C**
		0 0 3 2

OBJECTIVES:

To develop skill to use software to create 2D and 3D models.

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B- spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. Vblock, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a simple steel truss.
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing isometric projection of simple objects.
9. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 20% of classes for theory classes and 80% of classes for practice = 45 PERIODS

Note: drawings must be done by using any 2D drafting package)

CS2P8   **COMPUTER PRACTICES LABORATORY**   **L T P C**
                 (For all branches of B.E / B.Tech programmes)   **0 0 3 2**

LIST OF EXPERIMENTS:

1 Search, generate, manipulate data using MS office/ Open Office

2 Presentation and Visualization – graphs, charts, 2D, 3D

3 Problem formulation, Problem Solving and Flowcharts

4 C Programming using Simple statements and expressions

5 Scientific problem solving using decision making and looping.

6 Simple programming for one dimensional and two dimensional arrays.

7 Solving problems using String functions

8 Programs with user defined functions

9 Program using Recursive Function and conversion from given program to flow chart.

10 Program using structures and unions.

                                           TOTAL : 45 PERIODS

MD3T1

APPLIED MATHEMATICS FOR MECHANICAL ENGINEERS - I

L T P C

3 1 0 3

UNIT I
(INTERPOLATION AND NUMERICAL INTEGRATION)

Interpolation with equal intervals – Newton's forward interpolation formula – Newton's backward interpolation formula - Interpolation with unequal intervals: Lagrange's interpolation formula, Newton's divided difference formula - Numerical integration: Trapezoidal rule - Simpson's one-third rule - Simpson's three-eighth rule –Outline of applications of interpolation and numerical integration in engineering.

UNIT II
(LAPLACE TRANSFORMS AND APPLICATIONS)

Transforms of elementary functions : $1, t^n, e^{at}, \sin at, \cos at, \sinh at, \cosh at$ - Properties of Laplace transforms: Linearity Property, First shifting property, Change of scale property – Transforms of derivatives - Transforms of integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace transform - Inverse transforms: Method of partial fractions – Other methods of finding inverse - Convolution theorem (Without proof) - Unit step function – Unit Impulse Function -Application to differential equations – Outline of applications of Laplace transforms in engineering.

UNIT III
(NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS)

Picard's method – Taylor series method - Euler's method – Modified Euler's method – Runge's method – Runge-Kutta method – Predictor-corrector methods: Milne's method, Adams Bashforth method – Outline of applications of ordinary differential equations in engineering.

UNIT IV
(DIFFERENCE EQUATIONS AND APPLICATIONS)

Formation of difference equations – Linear difference equations – Rules for finding the complementary function – Rules for finding the particular integral – Simultaneous difference equations with constant coefficients – Outline of other applications of difference equations in engineering

UNIT V
(Z – TRANSFORM AND APPLICATIONS)

Standard z-transforms of $1, a^n, n^p$ – Linearity property – Damping rule – Shifting rules – Multiplication by n - Initial and final value theorems (without proof) – inverse z –transforms – Convolution theorem (without proof) – Convergence of z-transforms – Two sided z-transform – Evaluation of inverse z-transforms: Power series method, Partial fraction method, inversion integral method – Application to difference equations – Outline of applications of z-transform in engineering.

Note: Questions are to be set on problem solving and not on the theoretical aspects.

PRESCRIBED TEXT BOOK:
Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.

REFERENCES

1. Alan Jeffrey, Advanced Engineering Mathematics, Academic Press

2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons

3. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company.

ME3T2　　　　　　　　**ENGINEERING THERMODYNAMICS**　　　**L T P C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3 0 0 3

UNIT – I　　　　　　　　　　　　　　　　　　　　　　　　　　　9

BASIC CONCEPTS - Concept of continuum, macroscopic approach, Thermodynamics systems- Closed, open or control volume. Thermodynamic properties and equilibrium state of a system, State diagram, Path and process, Work, Modes of work, Zeroth law of thermodynamics - Concept of temperature and heat.
FIRST LAW OF THEMODYNAMICS
Application to closed and open system, Internal energy, Specific heat capacities C_v and C_p, Enthalpy, Steady flow process with reference to various thermal equipment.

UNIT - II　　　　　　　　　　　　　　　　　　　　　　　　　　9

SECOND LAW OF THERMODYNAMICS - Kelvin's and Classius statements of second law of thermodynamics - Reversibility and irreversibility - Carnot cycle, reversed Carnot cycle efficiency, COP - Classius inequality - Concept of entropy, Entropy of ideal gas, principle of increase of entropy - Carnot theorem.
AVAILABILITY
Reversible Work, Availability, Irreversibility for closed systems and steady state control volumes, II Law Efficiency.

UNIT - III　　　　　　　　　　　　　　　　　　　　　　　　　9

PROPERTIES OF PURE SUBSTANCES - Thermodynamics properties of pure substance in solid and vapor phases rule - P-V, P-T, T-V, T-S, H-S, Diagrams, PVT surfaces - Steam table of thermodynamics properties - Calculation of properties, work done and heat transferred in non-flow and flow process.

UNIT - IV　　　　　　　　　　　　　　　　　　　　　　　　　9

THERMODYNAMIC RELATIONS Gibbs and Helmholtz function – General thermodynamic relations - Exact differentials - T-ds relation - Maxwell, Classius - Clapeyron equation - Joule Thomson coefficient. Third law of thermodynamics.

UNIT - V　　　　　　　　　　　　　　　　　　　　　　　　　9

PSYCHROMETRY - Properties of moist air - Adiabatic saturation process - Psychometric charts - Sensible heating and Sensible cooling - Dehumidification, Heating and dehumidification –Cooling & Humidification - Adiabatic mixing of two streams.

　　　　　　　　　　　　　　　　　　　　　　　　　TOTAL : 45 PERIODS

TEXT BOOKS

1.   VANWVYLEN & SONNTAG, Classical Thermodynamics – Wiley Eastern.
2.   P.K. NAG, Engineering Thermodynamics –Tata –McGraw Hill.4th Edition.

REFERENCES

1   ROGER & MAYHEW, Engineering Thermodynamics – Addison Wiley, 2007, 4th Edition
2   J.P HOLMAN, Thermodynamics – McGraw Hill, 1995
3   MARK. W. ZEMANSKY AND RICHARD H. DITTMAN, Heat and Thermodynamics, McGraw Hill.
4   T. ROY CHOUDARY, Basic Engineering Thermodynamics, 1997, TMH
5   BRIJLAL N. SUBRAHMANYAM, Heat and Thermodynamics –S. Chand & Co.,
6   SPALDING & COLE, Engineering Thermodynamics, ELBS
7   MICHAEL SAAD, Thermodynamics, Prentice Hall, 1997
8   KENNETH WORK Jr, Advanced Thermodynamics for Engineers,
9   Mc Graw Hill, 1995.
10   M. S. YADAV, Thermodynamics, Anmol Publications Pvt Ltd, New Delhi. 2000.
11   C.P. Arora, Thermodynamics, TMH, 5th Edition.
12   S. C. Singhal, Engineering Thermodynamics, CBS Publishers, 2004, 1st Edition.
13   Y.V. C Rao, Engineering Thermodynamics, 2005 1st Edition.
14   P. L. Ballaney, Thermal Engineering, Khanna Publishers, 2007, 24th Edition.
15   R. K. Rajput, Thermal Engineering, Lakshmi Publishers, 2008, 6th Edition.

(Use of approved Thermodynamic property tables like Steam tables, Mollier chart, Psychrometric chart are permitted in all the examinations)

MATERIAL SCIENCE & METALLURGY **L T P C**

3 0 0 3

UNIT – I 9

Structure of Metal and alloys – Ionic, covalent and metallic bonding – space lattice, crystal structure, miller indices for atomic planes and direction, crystal defects – point line and plane defect, polymorphisms and allotropy grains and grain boundaries and simple problems - strengthening mechanism

Diffusion fick;s law of diffusion , solvation of fick's second lay and its applications, atomic model of diffusion an role of crystel defects, temperature dependence of diffusion co-efficient. Kirkendall effect.

UNIT – II 9

Mechanical Properties – Tensile test, luder's band, engineering stress – strain curve. True stress – strain curve, elastic deformation, plastic deformation – effect of mean stresses & notches. Creep test –p primary, secondary & Territory creep failure analysis. Hardness testing - Fatigue testing. Study of fractography.

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UNIT – III 9

Phase diagrams – phase rules, solid solutions, inter – metallic components, cooling curves, equilibrium diagram – isomorphous, eutectic, peritectic and eutecoid types – iron – carbon equilibrium diagram - phase transformation- TTT DIAGRAM, Transformations: General characteristics of martensitec reactions. Similarity to deformation twinning, bain distortion, crystallography & Kinetics of Martensitic transformation - Order – disorder transformation - influence of ordering on properties.

Types of steel, cast iron, slow cooling of steels, tool steel, alloy steel

UNIT – IV 9

Heat treatment of steels and non – ferrous materials annealing, normalizing, hardening, tempering – Austempering, Martempering, Case hardening techniques, Hardenability test. Powder metallurgy – processes and applications with examples.

UNIT – V 9

Alloys of Cu, Al, Mg, Ni. -

Polymer, fiber, Ceramics and composite materials – high strength alloys, super alloys, alloys of Titanium, Cobalt and their applications. Uncommon materials like Beryllium, Zirconium, Hafnium, Tantalum, Nobium and their applications. Cellular metallic materials, fusible alloy, Bearing materials, Ferromagnetic, Paramagnetic materials. Introduction to nano materials and nano composites.

TOTAL : 45 PERIODS

TEXT BOOKS

1.   G.E. DIETER, Mechanical Metallurgy, Mc Graw Hill, ISE.
2.   O.P KHANNA, Meterial Science and Metallurgy, Dhanpat Rai & Sons.2008, 1st Edition

REFERENCES

1   S.H.AVENER, Introduction to physical metallurgy, McGraw Hill, ISE
2   REYMOND A.HIGGINS, Engineering Metallurgy , ELBS.
3   C.SMALLMAN, Modern Physical Metallurgy. English Language Book, Butterworths, London.
4   LAWRENCE H. VANVLACK, Elements of Material science and Engineering Addition wiley Publishing Co.,
5   RAGHAVAN, Material Science and Engineering ,Prentice Hall India Ltd, 2007 5th Edition.
6   MARC ANDRE MEYERS & KRISHNAKUMAR CHAWLA, Mechanical Behaviour of Materials PHI, 1999.
7   MICHEL F. ASHBY & DAVID RH. JOFNNS, Engineering Materials – An Introduction to their properties and Applications – 2nd ed. Butterworths.
8   ANIL KUMAR Sinha, Ferrous Physical Metallurgy, Butterworths.
9   Material Hand Book, Vol – II, III & IV, ASM, 9th ed.
10   James F. Shackel Ford, Introduction to Material Science for Engineers, 2007 6th Edition.
11   V. Rajendiran, Material Science, TMH, 2005.
12   K.R. Phaneesh, Material Science and Metallurgy, Sudha Publications, 2007. 5th Edition.

CS3T6   OBJECT ORIENTED PROGRAMMING USING C++   L T P C
3 0 0 3

Unit - I   **9**

Need for object oriented programming, Characteristics of object oriented language -objects, classes, Inheritance, Reusability, creating new data types, Polymorphism and overloading C++ programming basics – Data types, Manipulators, Cin, Cout, Type conversion, arithmetic operators, Loops and decisions.

Unit – II   **9**

Class and objects : A simple class, C++ Objects as physical Objects, C++ Objects as Data Types, Constructors, destructors, objects as function arguments, overloaded constructors, member functions defined outside the class, inline functions.

Unit -III   **9**

Arrays: Defining & accessing Array elements, arrays as class member data, array of Objects. Operator Overloading: Overloading Unary Operators, postfix notations. Overloading Binary Operators - Arithmetic operators, Concatenating Strings, Arithmetic Assignment Operators.

Unit – IV   **9**

Inheritance-Derived class and base class, derived class constructors, overriding member functions, Class Hierarchies, Abstract base class, Public and private inheritance, Levels of inheritance, Multiple inheritance. Memory management – new and delete operator, a string class using new, Pointers to Objects – An array of pointers to Objects.

Unit - V   **9**

Virtual Functions – Pure virtual functions, Late Binding, Abstract Classes, Virtual base classes. Friend Functions, Static Functions, the copy constructor, the this pointer. Templates, function templates, class template.

TOTAL : 45 PERIODS

TEXT BOOKS

1.   Object Oriented Programming in Microsoft C++ - Robert Lafore,Galgotia Publication Pvt Ltd.
2.   Let us C++ - Yaswant Kanitkar(used for templates) ,BPB Publication

REFERENCE BOOKS

1.   Object Oriented Programming in C++ - E. Balaguruswamy, Tata Mcgraw Hill.
2.   Teach yourself C++ - Herbertsehildt, OSBORNE/MH

ME3T6   **MANUFACTURING TECHNOLOGY - I**   **L T P C**
                                                                       3 0 0 3

UNIT- I   **9**
CASTING PROCESESS- Introduction to casting - Patterns, Types, Pattern Materials, Pattern Allowances - Moulding - types- Moulding sand, Properties and Requirements of moulding sands, Gating & Risering, Cores & Core making.
Casting Process -   Shell, Investment, Die casting, Centrifugal Casting. Casting Defects

UNIT- II   **9**
MECHANICAL WORKING OF METALS- Introduction to Hot and Cold Working, Classification, Rolling, Types of Rolling Mills, working principle, Roll Pass, Rolling Defects
Forging, Types, Open Die forging, Impression, Closed Die Forging, Rotary Swaging, Die Materials, Lubrication, Forgeability, Forging Defects.
Wire Drawing, Principles and construction details, Extrusion-Types-Forward, Backward & Tube Extrusion

UNIT – III   **9**
SHEET METAL FORMING- Forming Operations- Blanking-blank size calculation, draw ratio, drawing force, Piercing, Punching, Trimming, Stretch Forming, Deep Drawing, Shearing, Metal Spinning, Bending, Tube bending, Tube forming -Embossing & Coining, Types of Dies, Progressive, Compound and Combination dies.
Forming Methods -   Explosive Forming, Electro Hydraulic Forming, Electro Magnetic Forming, Dynapack Machine, Rubber Forming, Super Plastic Forming.

UNIT- IV   **9**
METAL JOINING PROCESSES- Welding- Classifications - Welding Equipments, power requirement -Electrode Types - Specification, Gas welding - Types, Arc welding- Types, SMAW, Carbon Arc, TIG, MIG, Atomic Hydrogen, Co2 welding, Submerged Arc welding. Special welding Processes- Laser, Electron Beam, Plasma Arc, Ultrasonic, Electro slag, Friction welding, diffusion welding, electrical resistance welding. Soldering, Brazing. Welding Defects - welding inspection and testing.

UNIT- V   MANUFACTURE OF PLASTIC COMPONENTS   **9**
Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.
                                                    TOTAL : 45 PERIODS

TEXT BOOKS

1 Sharma. P.C., "A Text book of Production Technology" (Manufacturing Technology) , Sixth Edition, S.Chand & Company Ltd, New Delhi, 2007

2 Rao. P.N., "Manufacturing Technology", Metal Cutting & Machine Tools , Tata McGraw Hill Publishing Co, New Delhi, 2007.

3 Chapman W.A.J., "Workshop Technology Vol I & II", Arnold Publisher, 1996

4 Serope Kalpakjian, Steven R.Schmid "Manufacturing Engineering and Technology" Fourth Edition, 2004, Pearson Education

5 Jain.R.K, "Engineering Metrology " Twentieth Edition, Khanna Publishers, 2007

6 REFERENCE BOOKS

7 Banga T.R, Agarwal. R.K. & Manghrani. T.M., "Foundry Engineering", Khanna Publishers, New Delhi, 1995

8 Jain.R.K. "Production Technology" Khanna Publishers, 1988

9 Bhattacharyya.A. "Metal Cutting Theory and Practice", Central Book Publishers, 1984

10 S. K. Hajra Chowdhery, & A. K. Hajra Chowdhery, Elements of Workshop Technology, Vol 1 & 2, Media Promoters and Publishers, 2007, 14th Edition.

11 C. Elanchezhian, Production Technology, Easwar Press, 2005.

MECHANICS OF SOLIDS **L T P C**

3 1 0 3

UNIT - I 9

Stress & Strain: Concept of stress, axial loading, normal stress, shearing stress, bearing stress, stress on an oblique plane under axial loading, components of stress, ultimate and allowable stress, factor of safety, Concept of strain, normal stress under axial loading, stress-strain diagram, Hook's law, Poission's relation, elastic constants and their relation-mechanical and thermal stresses in simple and composite members, strain energy, resilience, impact load, Saint-Venant's principle-stress concentration.

UNIT II 9

Bending stress in simple and composite beams, biaxial stresses, principle stress & strain, maximum shearing stress, Mohr's circle for plane stresses, Shear stress in a beam of rectangular section, I –section. Shear force and bending moment diagram for determinate beam, cantilever, simply supported and overhanging beams.

UNIT III 9

Slope and deflection of beams by – Double Integration method, Maculay's method, Moment area method, conjugate beam method and strain energy method for determinate beam, Cantilever, Simply supported, Over hanging beam for various types of load with and without applied moment.

UNIT IV 9

Torsion of circular shaft, strain energy in torsion, stress concentration in torsion, shaft under action of varying torque, hollow shafts, combined bending and twisting of shafts, equivalent bending and twisting moments. Springs: Close coiled helical springs, Open coiled helical springs, Leaf springs, Spiral springs.

UNIT V 9

Thin cylinder and thin spherical shells – under internal pressure, volumetric strain on capacity. Column and struts – Combined bending and axial stresses, Euler formula for long columns. Empirical formulae for short columns – Applications.

TOTAL : 45 PERIODS

TEXTBOOKS
1   POPOV E.P, Mechanics of Solids, PHI, New Delhi, 1976
2   BEER & JOHNSON, Mechanics of materials, SI Metric Edition, McGraw Hill, ISE
3   L.S. SRINATH, Advanced Mechanics of Solids, TMH, 2009, 3rd Edition
REFERENCE BOOKS
1   GERE AND TIMENSENKO, Mechanics of Materials, CBS, 1986.
2   JACKSON AND WIRTZ, Statics and Strength of Materials, Schaum Series, 1983.
3   S. RAMAMRUTHAM AND R. NARAYAN, Strength of Materials, Dhanpat Rai and Sons, New Delhi.2007, 15th Editon.
4   RYDER G.H. , Strength of materials by ELBS.
5   S.P. TIMOSHENKO J.N GOODIER, Theory of Elasticity, Mc Graw Hill International Edition.
6   S.M.A.KAZIMI, Solid Mechanics, Tata McGraw Hill Publishing Company Ltd.
7   TIMOSHENKO & YOUNG, Engineering Mechanics, McGraw Hill
8   REES DWA. Basic Solid Mechanics, McMillan Press, London, 1997
9   Arthur P. Boresi, Advanced Mechanics of Materials, John Wiley & Sons Ltd, 1993, 5th Edition.
10   Dr. R. K. Bansal, Strength of Materials, Lakshmi Publishers, 2007, 4th Edition.
11   J. B. K Das, Mechanics of Materials, Sapna Book House, 2007.

SA3T3   **SANSKRIT & INDIAN CULTURE - III**   **L T P C**

2 0 0 1

Part - I

Unit I
 Importance of smrits & sutras ; significance of Manu's smrits & grihya sutran;

Unit II
 Samskaras or Sacraments – defination & significance; Sixteen important Samskaras in due course of human life special reference to the Hindu. Four Ashrama Dharmas.

Unit III
Worship & Festivals – Worship – Personal and   public worships; sixteen different kinds of *poojas*; *tantra* and *mudras* in *pooja*; significance and different types of Yajnas, utensils and requirements.   important sacred places and cultural centres; significance of festivals and impact on culture.

Part - II

Unit IV
Importance and significance of Upavedas.

Unit V
Special reference to Ayurveda and Arthasastra.

REFERENCE BOOKS

1. Acharya, D. 1999. *Dharnuveda* (sub-Veda of Yajurveda). Hindi. Vijaya Kumar Govindram Harsanand. Delhi.
2. Kangle, R.P. 1992 (rp). *The Kautilya Arthasastra.* Delhi.
3. Rao, S.K.R. 1994. *Nityarchana*. Agama-kosha (Agam Encyclopaedia). Kalpatharu Research Academy Publications. Vol X. Banglore.
4. Ray, P. (tr). 1997. *Vasistha's Dhanurveda Samhita*. J.J. Publishing House. Delhi.
5. Shalini, K. 1997. *Vedic Leguminous Plants* (Medical and Microbiological Study). Classical Publishing Company. New Delhi.

HR3T1   **HR SKILLS - I**   **L T P C**

                                                                   1 1 0 1

       English as a subject is being introduced for second year B.E/B.Tech students from 2014-2015. The objective is to impart intensive teaching to enable them to communicate in English both at the spoken and written levels. The expectations of the Campus Recruiters and other agencies are taken into consideration.

1. Words Misused

2. Homonyms and Homophones

3. One word substitution

4. Phrases and Clauses

5. Rearrangement of Sentences

6. Spotting Errors

BOOKS FOR REFERENCE:

1. *Objective General English* – Dr. R.S. Aggarwal (S.Chand and Co Pvt Ltd, New Delhi 110 055).

2. *Essential English* – A.P. Bharadwaj (S.Chand and Co Pvt Ltd, New Delhi 110 055).

3. *English Grammar and Composition -* Wren and Martin

4. *English for Engineering Students* – Dr. Sumant (VijayNicholas Publication)
   (Relevant portions in the syllabus will be selected from the books prescribed and given in a consolidated form to students.)

ASSESSMENT:

I. Examination for both the Semesters will be through Internal Assessment only. This will be for 100 marks each. A candidate has to secure 50% for a pass.

II. Internal Assessment will comprise of both oral and written examinations for 40 Marks.

III. End Semester Examination is of Practical Mode for 100 marks and this will be converted to 60.

ME3P7   **THERMAL ENGINEERING LAB**   **L T P C**

                                                               0 0 3 2

1. Performance test on single stage reciprocating air compressor
2. Performance test on constant speed centrifugal air blower
3. Valve timing diagram on single cylinder four stroke petrol engine
4. Port timing diagram on single cylinder two stroke petrol engine
5. Load test on single cylinder petrol engine
6. Performance test on high speed diesel engine with alternator loading
7. Preparation of heat balance sheet on slow speed diesel engine
8. Performance test on slow speed – diesel engine
9. Performance test on high speed – twin cylinder diesel engine
10. Performance, Noise and Smoke Measurement of computerized diesel engine.
11. Performance characteristic and Morse test on a multi cylinder petrol / diesel engine
12. Testing of fuels and lubricants using Say bolt and Redwood viscometer
13. Flash and fire point of fuels and lubricating oil.
14. Performance testing of Solar flat plate collector.
15. Performance testing of concentric (Parabolic) collector

TOTAL : 45 PERIODS

ME3P8   **METALLURGY LABORATORY**   **L T P C**
                                                                 0 0 3 2

Metallurgy lab

1. Preparation of specimen, macro micro etching techniques for metallographic examination
2. Study and use of metallurgical microscope, different types and their operations
3. Identification of plain and high carbon steel, quenched and tempered steel
4. Identification of stainless steel – HSS and alloy steel.
5. Identification of Grey C.I, White C.I, Malleable iron, SG iron.
6. Identification of Cu alloys, Mg alloys, Al alloys, Ni alloys, Bearings metals
7. Measurements of harden ability – Jomny end quench test
8. Grain size measurement by comparison with ASTM chart
9. Study of microstructure and hardness value before and after heat treatment such as annealing, normalizing, hardening and tempering.
10. Demonstration of various sand testing methods (moisture determination, permeability testing, & green strength testing)

TOTAL : 45 PERIODS

OBJECT ORIENTED PROGRAMMING USING C ++ L T P C

0 0 3 2

1 Program to print address of an individual using setw and endl manipulators

2 Program to compute Celsius from Fahrenheit cin and cout

3 Program to display multiplication table using for loop

4 Program to do mathematical operation using "do while and while"

5 Program to display detail of material on user's choices switch case and break statements

6 Program to count vowels in given string using if else

7 Program to carry out division by zero and to continue execution with the use of continuous statement even if the condition is false

8 Program to create a structure with the detail of students as member of structure and accept and print value of members

9 To demonstrate nested structure, dimension of typical room as one structure, length and width of the room being another structure

10 To use function to print character to specify number of items using pass by constant, value, variable, by reference and pass structure as arguments

11 To overload function for characters to print specified number of times and also to establish different numbers of arguments passing

12 Program to learn class and objects. To increment the value of two objects of the lass currency

13 To add data items of two different objects of a class and store it in the third class with the use of constructor, scope resolution operator, and object passed as parameters, distracters, constructors, overloading and returning objects

14 Program to print address of individuals, A class containing arrays as class members the member function should accept address from key board and assign values to address and display address this program also demonstrates string as class members too

15 Program to print address of individuals. Programs to demonstrate array of objects

16 Program to overload + , - , * , / arithmetic operator

17 Program to demonstrate inheritance

18 Program to record experienced of individuals. This has to be added without modifying the available class by multiple inheritance

19 Program to access a virtual member function with pointer

20 Program to access the this pointer to an object and to access data in object in point to

21 Program to know about friend functions acting as a bridge between two different classes.

TOTAL : 45 PERIODS

MD4T1   **APPLIED MATHEMATICS FOR MECHANICAL**   **L T P C**
                                          ENGINEERS - II

                                                                                     3 1 0 3

UNIT - I APPLICATIONS OF LINEAR DIFFERENTIAL EQUATIONS   9

Simple harmonic motion – Simple pendulum – Gain or loss of oscillations – Oscillations of a spring: Free oscillations, Damped oscillations, Forced oscillations (without damping), Forced oscillations (with damping) – Oscillatory electrical circuit – Electro-Mechanical analogy – Deflection of beams – Whirling of shafts – Applications of simultaneous linear equations

UNIT – II PARTIAL DIFFERENTIAL EQUATIONS   9

Formation of partial differential equations – Solution of a partial differential equation – Equations solvable by direct integration – Linear equations of first order – Non linear equations of the first order – Charpit's method - Homogeneous linear equations with constant coefficients –Rules for finding complementary functions – Rules for finding particular integral – Solution of homogeneous linear equation of any order.

UNIT- III NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 9

Classification of second order equations – Finite difference approximation to derivatives – Elliptic equations: Laplace Equation, Poisson's equation – Solution of Laplace's equation – Solution of Poisson's equation – Parabolic equations: Heat equation – Solution of heat equation – Hyperbolic equations: Wave equation – Solution of wave equation – Outline of applications of numerical solution of partial differential equations in engineering.

UNIT –IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   9

Method of separation of variables – Vibration of a stretched string: Wave equation – Solution of Wave equation - D'Alembert's solution of wave equation – One dimensional heat flow – Solution of heat equation – Two dimensional heat flow – Solution of Laplace equation: temperature distribution in long plates, Temperature distribution in finite plates.

UNIT- V COMPLEX INTEGRATION   9

Integration of complex functions – Cauchy's theorem (without proof) – Cauchy's integral formula (without proof) –Taylor's series (without proof)– Laurent's series (without proof) – Zeros and Singularities of an analytic function – Residues – Residue theorem (without proof) – Calculation of residues – Evaluation of real definite integrals: Integration around the unit circle, Integration around a small semi circle, Integration around rectangular contours, Indenting the contours having poles on the real axis – Outline of applications of complex integration in engineering.

Note: Questions are to be set on problem solving and not on the theoretical aspects.

                                                                    TOTAL : 45 PERIODS

PRESCRIBED TEXT BOOK
Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.

REFERENCES
1.   Brown J.W, Churchil R.V, Complex Variables and Applications, McGraw Hill
2.   Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3.   Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company

ME4T2   **FLUID MECHANICS & MACHINERY**   **L T P C**
                                                                         3 1 0 3

UNIT – I   **9**

Fluid Properties: Fundamental concepts of fluid flow-Viscosity-surface tension-capillarity, compressibility – buoyancy - continuity equation, energy equation and Bernoulli's equation, Flow measuring methods and instruments: Manometer - pitot tube – nozzle – venturimeter – orificemeter - Flow meter for closed conduit systems-Momentum & energy correction factors.

UNIT – II   **9**

Momentum and Moment of Momentum equation – Hegan - Poiseulli's equation - Darcy-Weisbach equation - derivation & application, Navier - stoke's equation-Statement and Application - Power Transmission in pipes - Operation of pipes in series and parallel - Operation under Zero flow condition in one pipe.

UNIT - III   **9**

Steady, unsteady, uniform, non-uniform, rotational and ir-rotational, laminar and turbulent flows. Source-Sink – Circulation - source or sink with circulation - Uniform flow with source or sink - Doublet - Uniform flow with source, sink and circulation - Half body- Rankine body - Streamlined body - Bluff body - Magnus effect - Lift and Drag coefficient calculations - for ideal and real fluid flow for compressible & Incompressible fluids - Different forms of drag.

UNIT - IV   **9**

DIMENSIONAL ANALYSIS AND PUMPS - Dimensional analysis – Buckingham Pi – theorem - Non-dimensional numbers - Dynamic similitude - specific speed – unit quantities.
Centrifugal pump - work done - head developed - Specific energy – Priming - Minimum starting speed - net positive suction head - Performance of multistage pumps - Performance curves – cavitation - working principles and applications of reciprocating , Gear and submergible pumps.

UNIT - V   **9**

HYDRAULIC TURBINES - Hydraulic turbines – Classification - working principles - Pelton wheel, Kaplan turbines - Francis turbines - velocity triangles - theory of draft tubes – Performance - Selection of turbines - governing of turbines - method of preventing hydraulic coupling - Torque converters.

                                                                            TOTAL : 45 PERIODS

TEXTBOOKS

1   H.R. VALLENTINE, Applied Hydrodynamics, S.I. Edition, ELBS, 1970.
2   J.F.DOUGLAS, J.M.GASIOREK AND J.ASWAFFIELD, Fluid Mechanics, ADDISON WILEY 1999.
3   K.L. KUMAR, Fluid Mechanics, TMH.

REFERENCES

1   VICTOR L. STREETER AND BENJAMIN WYLIE & KIETH W.BEDFORD, Fluid Mechanics, Mc Graw Hill 1999.
2   DOUGLAS, J.F, Solving Problems in Fluid Mechanics Vol I and Vol II, ELBS, 1986.
3   SHAMES, Mechanics of fluids, McGraw Hill ISE.
4   A.H CHURCH AND JAGDISH LAL, Centrifugal Pumps and Blowers, Metropolitan Book Company Pvt. Ltd., ND 1973.
5   MODI P.N SETH, Hydraulics, Fluid Mechanics & Machinery, Standard Book House. 2007, 16th Edition.
6   R.K BANSAL, Fluid Mechanics & Hydraulic Machines. 2008, 9th Edition.
7   K.SUBRAMANIA, Theory and application of Fluid Mechanics, TMH (P) Ltd., N.Delhi – 1993.
8   BISWAS, Introduction to Fluid Mechanics and Fluid Machines, TMH
9   Dr. K. R. Arora, Fluid Mechanics Hydraulics and Hydraulic Machines, Standard Publishers, 2007, 9th Edition.
10 S. K. Som, G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, TMH, 2008, 2nd Edition.
11 M. K. Natarajan, Principles of Fluid Mechanics, Oxford & IBH Publishing Company P Ltd, 1999, 2nd Edition.
12 C. P. Kothandaraman, Fluid Mechanics and Machinery, New Age Publishers, 2007, 2nd Edition.

ME4T3	**KINEMATICS OF MACHINES**	**L T P C**
		3 1 0 4

UNIT - I   **9**

Links, Pairs, Chains, Mechanisms, Inversion of machines, Structure - Degrees of freedom, inversion, Four bar chains. Velocity and acceleration: Velocity and acceleration of simple mechanism by relative velocity method. Klein's constructions for slider crank chain oscillating cylinder and swivel bearing mechanisms. Analytical solution for slider crank mechanisms.

UNIT - II   **9**

Cams: Types of cams and followers, displacement, velocity & acceleration curves for uniform velocity, uniform acceleration and retardation. SHM, cycloidal curves, lay out of profile of plate cams of the above types with reciprocating and oscillating followers – knife edge rollers and flat faced followers, cylindrical and face cams, polynomial cams, cams with special contours.

UNIT - III   **9**

Theory of gearing: Toothed gears, minimum number of teeth, length of arc of contact, interference.

UNIT - IV   **9**

Gear trains: Types, velocity ratio and torque calculation in epicyclic gear trains and differential gear train.

UNIT - V   **9**

Belt and rope drives, single plate, multiple plate,   cone clutches, power transmitted,

Brakes. Lubrication: Theory of lubrication, hydrostatic and hydrodynamic bearings,

frictional loss,   power in bearing.

                                                                                             TOTAL : 45 PERIODS

TEXTBOOKS

1   AMITABH GHOSH AND ASHOK KUMAR MALLIK, Theory of mechanism and Machines – 3nd Edition, Affiliated East West Press Limited, 2007.
2   J.E.SHIGLEY AND J.J.VICKER Jr. Theory of Machines and Mechanism, 2nd ed. Mc GrawHill ISE 1995
3   R.S. KHURMI & GUPTA .J.K, A text book of Theory of Machines, S. Chand & Co., 2008, 14th Edition.
4   G.K.GROVER, Mechanical Vibrations, New Chand and Brothers, Roorkee.

REFERENCES

1   J.HANNAH AND R.C STEPHENS ARNOLD, Mechanics of Machines – ISE 1986.
2   BEER & JOHNSTON 5TH Edition, Vector Mechanics for Engineers. McGraw Hill. ISE 1988.
3   THOMAS BEVAN – 3rd Edition, The Theory of Machines – CBS 1984.
4   P.L.BALLANEY, Theory of Machines, Khanna Publishers, 2005, 24th Edition.
5   S.S.RATTAN, Theory of Machines, TMH. 2008, 2nd Edition.
6   RAO .J.S. & DUKKIPATI. R.V. Mechanism and Machine Theory, 2nd ed. Wiley Eastern Ltd., 2007,
7   HAMILTON H. MABIE & CHARLES F. REINNOLTZ, Mechanisms and Dynamics of Machinery, 4th ed. John Wiley & Sons, 1995
8   THOMSON W.T, Theory of Vibration and Applications, PHI, 1975
9   Sadhu Singh, Theory of Machines, Pearson Education Ltd, 2007.
10 Ashok G. Ambekar, Mechanism and Machine Theory , Eastern Economy Edition. 2007.
11 John. J. Uicker, Theory of Machines and Mechanisms, Oxford University Press, 2008, 3rd Edition.

APPLIED THERMODYNAMICS   **L T P C**
                                                              3 0 0 3

UNIT - I   9

FLOW THROUGH NOZZLE - One-dimensional flow of steam through Convergent - Divergent Nozzle - Critical pressure ratio, super saturated flow in nozzles.
STEAM TURBINES - Impulse and Reaction turbine Principles - Compounding – Types - Velocity diagrams for simple and multistage turbines - Speed regulations – Governors.

UNIT - II   9

GAS POWER CYCLES -   Air Standard Cycles - Otto, Diesel, Dual, Brayton ,Gas turbine cycle Analysis - methods of cycle improvement. Regenerative, intercooled, reheated cycles and their combinations - performance calculations.

UNIT - III   9

REFRIGERATION - Refrigeration cycles- Reversed Carnot cycle - Vapour compression system - Vapour absorption refrigeration system-   Properties of refrigerants – Multi pressure refrigeration systems- Gas cycle refrigeration, ejector compression refrigeration systems - Refrigeration equipments – Compressors - Condensers - Expansion devices - Evaporators.

UNIT - IV   9

RECIPROCATING AIR COMPRESSORS - Working principle – work done - Effect of clearance volume - Single and multi stage compressors, Volumetric efficiency – Intercooling in multistage compressors, calculation of power requirement – Rotary compressors.

UNIT- V   9

AIR CONDITIONING **-** Principles of air-conditioning - Types of A/C Systems - Summer, Winter - Comfort and Year round air conditioners – Window & Centralised A/c - heat load calculations – Concept of GSHF – RSHF - ESHF

                                                              TOTAL : 45 PERIODS

TEXT BOOKS
1. VANWVYLEN & SONNTAG, Classical Thermodynamics – Wiley Eastern.
2. P.K. NAG, Engineering Thermodynamics –Tata –McGraw Hill.4th Edition.
3. ROGER & MAYHEW, Engineering Thermodynamics – Addison Wiley, 2007, 4th Edition
4. J.P HOLMAN, Thermodynamics – McGraw Hill, 1995
5. Y.V. C Rao, Engineering Thermodynamics, 2005 1st Edition.
6. P. L. Ballaney, Thermal Engineering, Khanna Publishers, 2007, 24th Edition.
7. R. K. Rajput, Thermal Engineering, Lakshmi Publishers, 2008, 6th Edition.

REFERENCES
1. MARK. W. ZEMANSKY AND RICHARD H. DITTMAN, Heat and Thermodynamics, McGraw Hill.
2. T. ROY CHOUDARY, Basic Engineering Thermodynamics, 1997, TMH
3. BRIJLAL N. SUBRAHMANYAM, Heat and Thermodynamics –S. Chand & Co.,
4. SPALDING & COLE, Engineering Thermodynamics, ELBS
5. MICHAEL SAAD, Thermodynamics, Prentice Hall, 1997
6. KENNETH WORK Jr, Advanced Thermodynamics for Engineers,
7. Mc Graw Hill, 1995.
8. M. S. YADAV, Thermodynamics, Anmol Publications Pvt Ltd, New Delhi. 2000.
9. C.P. Arora, Thermodynamics, TMH, 5th Edition.
10. S. C. Singhal, Engineering Thermodynamics, CBS Publishers, 2004, 1st Edition.
(Use of approved Thermodynamic property tables like Steam tables,
R & A/C Mollier chart, Psychrometric chart are permitted in all the examinations)

MANUFACTURING TECHNOLOGY - II   **L T P C**
                                                                  3 0 0 3

OBJECTIVES:
•   To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.

UNIT - I THEORY OF METAL CUTTING   **9**
Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT - II TURNING MACHINES   **9**
Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

UNIT - III RECIPROCATING, MILLING AND GEAR CUTTING MACHINES   **9**
Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making : Drilling ,reaming,boring,Tapping, Milling operations-types of milling cutter –attachments- machining time calculations -,Gear cutting – forming and generation principle, gear milling , hobbing and gear shaping – micro finishing methods

UNIT – IV ABRASIVE PROCESS AND BROACHING   **9**
Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding- micro finishing methods - Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT- V NON TRADITIONAL MACHINING PROCESS   **9**
- Introduction, Classification, Applications, Benefits, Construction and working Principle of Various Processes - Abrasive jet machining Electrical discharge machining, Wire cut EDM Process, Electro chemical machining, Electro chemical grinding, Electron beam machining, Laser beam machining, Plasma jet machining.

                                              TOTAL : 45 PERIODS

TEXT BOOKS

1   Milton C.Shaw " Metal Cutting Principles" Oxford Science Publications, 1997
2   Juneja B.L , Fundamentals of Metal Cutting and Machine Tools, 2nd Edition, New Age Internal Publishers,2005
3   Sharma. P.C., "A Text book of Production Technology" (Manufacturing Technology) , Sixth Edition, S.Chand & Company Ltd, New Delhi, 2007
4   Serope Kalpakjian, Steven R.Schmid "Manufacturing Engineering and Technology" Fourth Edition, 2004, Pearson Education
5   Sharma.P.C. " A Text Book of Production Engineering " Tenth Edition, S.Chand & Company Ltd, New Delhi, 2002.

REFERENCES

1   Rao. P.N., "Manufacturing Technology", Metal Cutting & Machine Tools , Tata McGraw Hill Publishing Co, New Delhi, 2000.
2   ROY. A LINDBERG, Process and Materials of Manufacture, PHI, New Delhi.
3   PAUL RANKY, Introduction to Flexible Manufacturing Systems.
4   W. A. J CHAPMAN, Workshop Technology, Arnold publishers Vol - III
5   R.K. JAIN. Production Technology, Khanna Publishers
6   YUSUF ALTINATAS, Manufacturing An Introduction – Cambridge University Press, 2000.
7   PHILLIP F. OSTWALD, JAINO MUNOZ, Manufacturing Process and Systems, 9th edition, John Wiley & Sons, 1998.
8   M.HASTLE HURST, Manufacturing Technology, ELBS
9   Hazra Choudhury S.K & Hazra Choudhury A.K, Elements of Manufacturing Technology, Vol-II, Media Publications.
10 C. Elanchezhian, Production Technology, Easwar Press, 2005.

EE4T8   **APPLIED ELECTRICAL & ELECTRONICS ENGINEERING**   **L T P C**
3 0 0 3

UNIT- I   ELECTRIC DRIVES: **9**
DC MACHINES AND TRANSFORMERS: DC motors and Transformers– methods of excitation, Speed-torque characteristics-auto transformer – three phase connections – parallel operation of transformers – phase conversion – tap changing.
AC MACHINES: Induction Machines - Single phase and three phase Induction motors, double revolving field theory, Speed-torque characteristics, Synchronous machines-Types.

UNIT- II SPECIAL MACHINES AND INDUSTRIAL APPLICATIONS   **9**
Shaded – Pole induction motor –hysteresis motor – AC series motor – repulsion motor – linear motor – permanent magnet DC and AC motors.
Selection factors for the motors, Power rating of drive motors, Selection of motors for Cranes, Machine tool applications and Centrifugal pumps.

UNIT- III ELECTRONIC CIRCUITS: **9**
Semiconductors, diodes, transistors and Rectifier, Capacitive filters, Zener voltage regulator, RC- DMA - Diac, Triac, Switching transistors - Concept of feedback-Negative and Positive feed back – RC phase shift, Hartley, Colpit's, Wien bridge oscillators.

UNIT- IV   DIGITAL ELECTRONICS AND MICROPROCESSOR   **9**
Operational Amplifier and its Characteristics – Voltage to Current Converter - Current to Voltage Converter - Schmitt trigger circuit- Astable Multivibrator - DAC – ADC.
Architecture of 8085-Pin configuration-Instruction set- Format & Types -Addressing modes- machine cycles, timing and memory diagrams, Memory Mapped I/O– Stack and Subroutines.- Simple programs using arithmetic and logical operations.

UNIT- V   INTERFACING AND APPLICATIONS OF MICROPROCESSOR   **9**
Basic interfacing concepts - Interfacing of Input and Output devices, Programmable Peripheral Interface IC 8255
Applications of 8085 Microprocessor: Temperature control, Stepper motor control, traffic light control – Electronic weighing system, Data Logger.

                                                                        TOTAL : 45 PERIODS

TEXT BOOK

1   Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 1990.
2   B.L.Theraja & A.K.Theraja, "Electrical Technology" , Vol – II, S.Chand Company Ltd, New Delhi, 2007.
3   G.K Mitthal Electronic Devices and Circuits. Khanna Publications .
4   Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCES

1   Fitzgerald,A.E.Charles Kingsley Jr.Stephen D.Umans, 'Electric Machinery', McGraw-Hill Book Company,1992
2   Syed A.Nassar, 'Electric Machines and Power System', Volume I, McGraw-Hill Inc., New York, 1995.
3   Nagrath,I.J.and Kothari.D.P., 'Electric Machines', T.M.H publishing Co Ltd., New Delhi 1990.
4   Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill publishers, 1995.
5   Roi Chowdry, Shalltain and Jain "Linear Integrated Circuits", Wiely Eastern M.Morris Mono – Digital Logic & Computer Design – PHI, II Edn, 1999
6   .Dougles V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.

SA4T4	**SANSKRIT & INDIAN CULTURE – IV**	**L T P C**
		2 0 0 1

Part - I

Unit I

Religion and different philosophical Schools - evolution of religious thoughts and ritual practices; astica and nastica sets; Jaina & Buddhist philosophy.

Unit II

Bhakti Movement – evolution of trimurti tradition and Bhakti movement; Shankara, Ramanuja, Madhwa, Vellabha, Bhaskara, etc. personalities and their contribution in Indian philosophy; Alwars, Nayanmars, Kabir, Tulasi, Meera, Goswami, etc. and their role in Bhakti movement;

Unit III

Important personalities and their Contribution – Devarishies, Maharishies, Rishies, Seers and contribution of their institutions to protect the cultural heritage.

Part - II

Unit IV

Significance of Yoga in daily life.

Unit V

Vedic Mathematics, Astrology & Astronomy, Jyotism, etc. early Indian works and its importance in day to day life.

REFERENCE BOOKS

1. Datta, B. & A.N. Singh. 1962(rp). *History of Hindu Mathematics.* 2 Vols. Asian Publishing House. Bombay.
2. Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaj. 1994 *Vedic Mathematics*. Motilal Banarasidas. New Delhi.
3. Kulkarni, R.P. 1983. *Geometry according to Sulba Sutra*. Samsodhana Mandal. Pune.
4. Radhakrishna, S. 1993(rp). *Indian Philosophy*. Vol I & II. Oxford University Press. Delhi.
5. Rao, J. 1960. *Principles and Practices of Medical Astrology*. Raman Publications. Banglore.
6. Swami Satyananda Saraswati. 1997 (rp). *Asanas Pranayama Mudra Bandha*. Bihar Yoga Bharati. Bihar.

HR4T2	HR SKILLS - II	L T P C
		1 1 0 1

The objective is to impart intensive teaching to enable them to communicate in English both at the spoken and written levels. The expectations of the campus recruiters and other agencies are taken into consideration.

1. Idioms and Phrasal Verbs (Reference: S. No. 4 Prescribed)
2. Synthesis of Sentences
3. Sentence Completion
4. Paragraph Coherence
5. Same Theme Sentences – Selection of Preferable Sentence
6. Comprehension (True/False, Inference, MCQ)

BOOKS FOR REFERENCE:
1. Objective General English – Dr. R.S. Aggarwal (S.Chand and Co Pvt Ltd, New Delhi 110 055).
2. Essential English – A.P. Bharadwaj (S.Chand and Co Pvt Ltd, New Delhi 110 055).
3. English Grammar and Composition - Wren and Martin
4. English for Engineering Students – Dr. Sumant (VijayNicholas Publication)
   (Relevant portions in the syllabus will be selected from the books prescribed and given in a consolidated form to students.)

ASSESSMENT:
I.   Examination for both the Semesters will be through Internal Assessment only. This will be for 100 marks each. A candidate has to secure 50% for a pass.
II. Internal Assessment will comprise of both oral and written examinations for 40 Marks.
III. End Semester Examination is of Practical Mode for 100 marks and this will be converted to 60.

ME4P7   **FLUID MECHANICS AND MACHINERY LABORATORY**   **L T P C**
                                                                           0 0 3 2

1.   Verification of Bernoulli's equation
2.   Calibration of orifice meter and Venturi meter
3.   Flow through nozzle
4.   Flow through notches and weirs
5.   Flow through pipes and losses in pipes
6.   Buoyancy experiment – Meta centric height
7.   Wind tunnel – Drag and Lift measurement
8.   Performance characteristics of centrifugal pump
9.   Performance characteristic of reciprocating pump
10.   Performance characteristic of gear oil pump
11.   Performance characteristic of deep jet valve pump
12.   Performance characteristic of submersible pump
13.   Performance Characteristics of reaction turbine
14.   Performance Characteristics of Impulse turbine
15.   Performance Characteristics of Kaplan turbine

TOTAL : 45 PERIODS

ME4P8   **STRENGTH OF MATERIALS LABORATORY**   **L T P C**
                                                                  0 0 3 2

1   Tension test on MS rod and twisted bar (Electronic UTM)
2   Compression test on bricks and concrete blocks (Electronic UTM)
3   Comparison of hardness value of steel, copper and aluminium using Rockwell, Brinell and Vickers hardness measuring machines
4   Estimation of notch toughness of steel using impact testing machine
5   Fatigue test on steel
6   Compression test on wood
7   Estimation of spring constant under tension and compression
8   Tension test on MS wire (Tensile Testing Machine)
9   Double shear test (Electronic UTM)
10   Torsion test on mild steel.

TOTAL : 45 PERIODS

EE4P7   **ELECTRICAL MACHINES LABORATORY**   **L T P C**
                                                                0 0 3 2

1.   Speed control of DC shunt motor

2.   Load test on DC shunt motor

3.   Load test on DC series motor

4.   Open circuit characteristic of a separately exited DC generator

5.   Open circuit characteristic curve of self exited DC shunt generator

6.   Load test on DC series generator

7.   Load test on three phase alternator

8.   Load test on three phase CAGE INDUCTION motor

9.   Load OC & SC Test on Single phase Transformer

10.   Load test on single phase transformer

11.   Study of AC&DC motor starters.

TOTAL : 45 PERIODS

MD5T1   **APPLIED MATHEMATICS FOR MECHANICAL**   **L T P C**
ENGINEERS - III

                                                            3 1 0 3

UNIT- I FOURIER SERIES   **9**

Euler's Formulae (Without Proof) – Condition for Fourier expansion – Functions having points of discontinuity – Change of interval – Expansions of even and odd functions - Half-Range series – Parseval's formula (without proof) – Root mean square value (without proof) – Typical waveforms (Definition Only): Square wave form, Saw toothed waveform, Modified saw toothed waveform, Triangular waveform, Half wave rectifier, Full wave rectifier - Outline of applications of Fourier series in engineering

UNIT – II CALCULUS OF VARIATIONS   **9**

Functionals – Euler's Equation - Solutions of Euler's equation – Geodesics – Isoperimetric problems – Several dependant variables – Functionals involving higher order derivatives – Approximate solution of boundary value problems: Rayleigh-Ritz method.

UNIT- III COLLECTION AND ANALYSIS OF DATA   **9**

Classification and tabulation of data - Frequency tables - Graphical representation - Measures of central tendency : Averages, mean, median, mode, Geometric and harmonic means - Measures of dispersion : Range, quartile deviation, Mean deviation, Standard deviation - Relative distribution - Moments - Skewness - Kurtosis - Linear correlation - Coefficient of correlation - Grouped data : calculation of correlation coefficient - Rank correlation - Linear regression - Regression lines.

UNIT – IV ANALYSIS OF TIME SERIES   **9**

Measurement of trend: Freehand method, Semi-average method, Moving average method, Method of least squares – Measuring trends by logarithms – Measurement of seasonal variations: Method of simple averages, Ratio-to-trend method, Ration-to-moving average method, Link relative method – Measurement of cyclic variations: Residual method, Reference cycle analysis method, Direct method, Harmonic analysis method – Measurement of irregular variations – Outline of applications of analysis of time series in engineering.

UNIT – V DESIGN OF EXPERIMENTS   **9**

Parameters and statistics – Sampling distribution – Tests of hypothesis and tests of significance – Critical region and level of significance – Errors in testing of hypothesis – One tailed and two tailed tests – Procedure for testing of hypothesis – Design of experiments – Completely randomized design: Analysis of variance for one factor of classification – Randomized block design: Analysis of variance for two factors of classification – Latin square design: Analysis of variance for three factors of classification – Outline of applications of design of experiments in engineering.

Note: Questions are to be set on problem solving and not on the theoretical aspects.

                                                      TOTAL : 45 PERIODS

PRESCRIBED TEXT BOOKS

1 Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.
2 Gupta S.P, Statistical Methods, 31st Edition, Sultan Chand and Sons., New Delhi, 2002.

REFERENCES

1 Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2 Forsyth, Calculus of variations, Cambridge.
3 Snedecor George W. Cocharan William G, Statistical Methods, Affiliated East West Press.

ME5T2   **HEAT AND MASS TRANSFER**   **L T P C**

                                                                   3 0 0 3

UNIT- I   **9**

CONDUCTION - Introduction to conduction heat transfer, Fourier's law of conduction, thermal conduction equation – derivation in Cartesian, cylindrical coordinates. One dimensional steady state conduction in plane wall and composite wall – thermal resistance, electrical analogy. Radial system – cylinder, sphere. Convective boundary condition, overall heat transfer coefficients, critical thickness of insulation, heat generation in plane wall, cylinder and sphere. Conduction and convective system – fins with different boundary conditions, thermal contact resistance, variable conductivity.

UNIT- II   **9**

CONDUCTION IN TWO DIMENSION - Steady state conduction in two dimension, conduction shape factor numerical method of analysis, unsteady state conduction – Lumped heat capacity system, significance of Biot and Fourier numbers, transient heat flow in a semi-infinite solid, use of Heisler and Grober charts. Heat transfer in multi dimensional system,

UNIT - III   **9**

CONVECTION - Review of boundary layer and thermal boundary layer. Differential and integral equation for hydrodynamic and thermal boundary layer. Similarity between heat, mass and momentum boundary layer. Significance of non-dimensional number in convection. Dimensional analysis for free and forced convection.
FORCED CONVECTION - Heat transfer from flat plate, flow through pipes, use of empirical relations.
 FREE CONVECTION - Heat transfer from vertical, horizontal and inclined surfaces.

UNIT - IV   **9**

RADIATION **-** Nature of thermal radiation, Black body concept, Grey body, Radiation shape factor, Relationship between shape factor, radiation heat transfer between two surfaces, Electrical analogy, reradiating surface, radiation shield, gas radiation, heat exchange between gas volume and enclosure.

UNIT - V   **9**

HEAT EXCHANGER- Types of heat exchangers – shell and tube, one – pass, two – pass, multi-pass, double-pipe, fouling factor, overall heat transfer co-efficient, LMTD and NTU Methods
Phase change heat transfer – boiling –condensation.
Mass Transfer – convective and diffusion mass transfer- fick's law- equimolar counter diffusion- isothermal evaporation of water into air.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. J.P.HOLMAN, Heat Transfer – SI Metric ed. McGraw Hill, ISE, 2002, 9th Edition.
2. NECATI M. OZISIK, Heat Transfer, McGraw Hill, ISE, 1998
3. KOTHANDARAMAN C.P, Fundamentals of Heat & Mass Transfer, New Age International, 2007, 3rd Edition.

REFERENCES:

1. CHAPMAN, Heat Transfer – Maxwell McMillan ISE, 1986.
2. BIJHON, Convective Heat Transfer – John Wiley.
3. Schaum Series, Heat Transfer, McGraw Hill, ISE
4. SACHDEVA R.C, Heat and Mass Transfer, New Age International (P) Ltd., 2007, 2nd Edition.
5. T. K. BASE, Numerical Fluid Dynamics, Narasa Publishing House, New Delhi, 1997.
6. ARTHOR P. FRAAS, Heat Exchanger Design, John Wiley & Sons, 1997.
7. Frank Kreith, Principles of Heat Transfer, Thomson India Edition, 2001.
8. S. P. Venkatesan, Heat Transfer, Ane Books, 2004.
9. Kern, Process Heat Transfer, TMH, 2007.
10. Y. V. C. Rao, Heat Transfer, University Press, 2001.
11. Domkundwar, Heat and Mass Transfer, Dhanpat Rai India Ltd, 2008, 7th Edition.

TOTAL : 45 PERIODS

(Use of approved Heat and Mass transfer Data book & Steam Tables permitted for all examinations)

ME5T3   **DYNAMICS OF MACHINES**   **L T P C**

                                                                      3 1 0 4

UNIT - I   **9**
BALANCING - Static and dynamic balancing of rotating masses in different planes, partial balancing of reciprocating masses of in – line, V, W and radial engines. Hammer blow and swaying couple in locomotive, direct and reverse crank method.

UNIT - II   **9**
INERTIA FORCE - Inertia force and inertia torque calculation. Turning moment diagrams, reciprocating engine mechanisms, fluctuation of energy and speed, Weight of flywheels.

UNIT - III   **9**
GOVERNORS AND GYROSCOPE - Function of governors – porter, proell and spring-loaded governors, sensitivity, stability, hunting and isochronisms, effect of friction, calculation of equilibrium speeds and ranges of speed of governors.
Gyroscope – couple and effect, in ship and motor cycle, car, aircraft and space vehicles, Gyroscope stabilization.

UNIT - IV   **9**
FREE VIBRATION - Undamped free vibration of single degree of freedom system, simple pendulum, compound pendulum, inclined spring-mass system, equivalent stiffness of spring combinations – springs in series, springs in parallel, combined series and parallel springs.
 Damped free vibration of single degree of freedom systems, types of damping, free vibrations with viscous damping, critically damped system, under damped system.

UNIT - V   **9**
FORCED VIBRATION - Forced vibration of single degree of freedom system. Constant harmonic excitation, steady state vibration, magnification factor with frequency ratio for various damping.
Transverse vibrations of beams –natural frequency by energy method, Dunkerly method-Vibration isolation and transmissibility, whirling of shafts.
Torsional vibrations: Torsional vibrations of single and multiple rotor systems, Equivalent shafts, Geared systems, Holzer's method.

                                                      TOTAL : 45 PERIODS

TEXTBOOKS

1   AMITABH GHOSH AND ASHOK KUMAR MALLIK, Theory of mechanism and Machines – 3nd Edition, Affiliated East West Press Limited, 2007.
2   J.E.SHIGLEY AND J.J.VICKER Jr. Theory of Machines and Mechanism, 2nd ed. Mc GrawHill ISE 1995
3   R.S. KHURMI & GUPTA .J.K, A text book of Theory of Machines, S. Chand & Co., 2008, 14th Edition.
4   G.K.GROVER, Mechanical Vibrations, New Chand and Brothers, Roorkee.

REFERENCES

1 J.HANNAH AND R.C STEPHENS ARNOLD, Mechanics of Machines – ISE 1986.
2 BEER & JOHNSTON 5TH Edition, Vector Mechanics for Engineers. McGraw Hill. ISE 1988.
3 THOMAS BEVAN – 3rd Edition, The Theory of Machines – CBS 1984.
4 P.L.BALLANEY, Theory of Machines, Khanna Publishers, 2005, 24th Edition.
5 S.S.RATTAN, Theory of Machines, TMH. 2008, 2nd Edition.
6 RAO .J.S. & DUKKIPATI. R.V. Mechanism and Machine Theory, 2nd ed. Wiley Eastern Ltd., 2007,
7 HAMILTON H. MABIE & CHARLES F. REINNOLTZ, Mechanisms and Dynamics of Machinery,   4th ed. John Wiley & Sons, 1995
8 THOMSON W.T, Theory of Vibration and Applications, PHI, 1975
9 Sadhu Singh, Theory of Machines, Pearson Education Ltd, 2007.
10 Ashok G. Ambekar, Mechanism and Machine Theory , Eastern Economy Edition. 2007.
11 John. J. Uicker, Theory of Machines and Mechanisms, Oxford University Press, 2008, 3rd Edition.
12 S. S. Rao, Mechanical Vibrations, Pearson Education, 2007, 4th Edition.
13 J. B. K. Das, Dynamics of Machinery, Sapna Book House, 2007.

ME5T4   **METROLOGY AND MEASUREMENTS SYSTEMS**   **L T P C**

3 0 0 3

UNIT - I BASIC CONCEPTS   9

Measurement system elements, Experimental Test Plan- Random Tests, Replication & repetition, Calibration - Sensitivity, Range, Accuracy, Standards, Traceability. Measurement Systems Models - First order systems, second order systems, Transfer functions- Signal flow graphs, Block diagram algebra

UNIT - II METROLOGY   9

Interferometry - Slip gauges, Comparators, Abbe's principle, Pneumatic transducer, Electronic transducers, Angle Measurement- Sine bar, angle gauges Optical instruments- Profile projectors, Autocollimators. Surface finish- Parameters, Stylus instruments. Limits and fits, Tolerance of gauges, Evaluation of geometric tolerances, Screw thread measurements, Gear measurements. Coordinate Measuring Machines- Construction, Operations, types and applications. Machine Vision.

UNIT - III PRESSURE, TEMPERATURE AND STRAIN MEASUREMENTS   9

PRESSURE MEASUREMENT: Gravitational, Bourdon, Elastic transducers, strain gauge, Pressure cells, Measurement of high and low pressure,
TEMPERATURE MEASUREMENT- Expansion thermometers, Resistance Temperature Detectors, Thermistors, Thermocouples, Radiative measurements.
STRAIN MEASUREMENT- Strain gauges, types, surfaces preparation and bonding technique, Wheatstone Circuit, Temperature compensation, Gauge rosettes, Calibration.

UNIT- IV FLOW, DENSITY AND VISCOSITY MEASUREMENTS   9

FLOW MEASUREMENT: Orifice, Flow nozzle, Venturi, Pitot tube, Rotometer, Turbine type Anemometer, Hot-wire anemometer, Magnetic flow meter, Ultrasonic flow meter.
DENSITY MEASUREMENT: Phenometer, Hydrometer, differential bubbling, Liquid level Measurements.
VISCOSITY MEASUREMENT: Capillary tube viscometer, efflux viscometer, falling sphere viscometer, Rotating cylinder viscometer.

UNIT- V HUMIDITY, VIBRATION, FORCE AND TORQUE MEASUREMENTS   9

HUMIDITY MEASUREMENT: Sling psychrometer, Absorption hydrometer, Dew point meter.
VIBRATON MEASUREMENT: Vibrometer and different types of accelerometer.
FORCE MEASUREMENT: Scales & balance, Elastic force meter, Strain gauge, Load cells Hydraulic and pneumatic load cells.
TORQUE MEASUREMENT: Mechanical torsion meter, Optical torsion meter, Electrical torsion meter, Strain gauge torsion meter.

TOTAL : 45 PERIODS

TEXTBOOKS

1   Gupta.I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
2   C. V.COILETE & AD. HOPE, Engineering Measurements, 2nd ed. ELBS.
3   THOMAS G. BECKWITH. N. LEWIS BUCK. ROY D. MARARGONJ, Mechanical Measurements, Narosa Publishing House 2008, 6th Edition, New Delhi.

REFERENCES

1   Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
2   Shotbolt, "Metrology for Engineers, McGraw Hill, 1990.
3   SIROHI RS. & RADHAKRISHNAN H.C, Mechanical Measurement, New Age International (P) Ltd., 2005, 3rd Edition.
4   RANGAN C.S, SARMA G.S & MANI VSV, Instrumentation Device and Systems, TMH, 1989
5   DOEBLIN, Measurement Systems Application and Design, TMH, 1990
6   A. K. Sawhney, Mechanical Measurements and Instrumentation, Dhanpat Rai & Company (P) Ltd, 2007, 12th Edition
7   R.K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, 2004, 12th Edition.

ME5T5   **MACHINE DRAWING**   **L T D C**

2 0 3 3

Indian standard code of practice for engineering drawing – General principles of presentation, Conventional representations of threaded parts, springs, gear and common features, Abbreviations and symbols for use in technical drawings, conventions for sectioning and dimensioning.

Tolerance – types – representation of tolerances on drawing, Fits – types – selection of fits – allowance.

Geometric tolerances – Form and positional tolerances – Datum, Datum features.

Maximum material principle – Symbols and methods of indicating it on drawing – Surface finish symbols – Welding symbols method of indicating it on drawing.

Preparation of working drawing for machine components like:

Fastenings-nuts, bolts-screws, keys, keyways. Riveted joints.

Joints-Cotter joint and Knuckle joint, Flange coupling, Universal coupling.

Connecting rod, Plummer block, Screw jack, Cross head for horizontal and vertical engines, Swivel bearing, Machine vice, Lathe tail stock, Tool head of the shaper.

TOTAL : 45 PERIODS

TEXT BOOKS

1   GOPALAKRISHNAN, Machine Drawing, Subash Publishers.
2   N.D BHATT, Machine Drawing, Charotar Publishing House, Anand. 2007, 42nd Edition.
3   N.SIDDHESWAR, P.KANNIAH, & V.V.S SATRY, Machine Drawing, Tata McGraw Hill, 2008.
4   M.C.MATHUR AND R.S VAISHWANAR, Engineering Drawing and Graphics
5   Goutam Pohit, Machine Drawing with Auto CAD, Pearson Education, 2007.
6   K. L. Narayana, Machine Drawing, New Age Publication, 2007, 3rd Edition.

Revised IS codes

10711, 10713, 10714, 9609, 1165, 10712, 10715, 10716, 10717, 11663, 11666, 10968, 11669, 8043,8000.

ME5T7   **AUTOMOBILE ENGINEERING**   **L T P C**

3 0 0 3

UNIT - I   9
Vehicle construction – chassis and body – integral and chassis mounted body – specifications, engine – types – construction – power and torque requirements – cylinder arrangement, operation, road performance under different speed and load conditions – choice of engine for different applications – engine trouble shooting, pollution and control – Indian emission standards.

UNIT - II   9
Principle of steering – steering geometry and wheel alignment– steering linkages – power steering, wheels and tyres– construction– type and specification– tyre wear and causes, front and rear axle– types– sub-axles.
Suspension systems – need of types – independent – coil and leaf spring and air suspensions, torsion bar, shock absorbers.

UNIT - III   9
Clutches – need – types – single and multi-plate-diaphragm clutch – over-running clutch – fluid coupling.
Gear boxes – manual and automatic – epi-cyclic and hydromatic transmission, universal joint, propeller shaft, hotchkiss drive, torque tube drive, differential – need and types – construction – four wheel drive.

UNIT - IV   9
Brakes - need – types – mechanical, hydraulic and pneumatic – details of components, redundancy in brake systems, trouble shooting in brake system, power brake.
Alternative fuels – hydrogen – compressed natural gas (CNG) – liquefied petroleum gas (LPG), alternative power plants – electric – hybrid vehicle – fuel cells.

UNIT - V   9
Carburetors, electronic fuel injection systems – mono point and multi point types, principles of modern electrical systems – battery, dynamo, alternator, starting motor, lighting and ignition (battery and electronic types) – automobile air conditioning, turbo charging.

TOTAL : 45 PERIODS

TEXTBOOKS
1   JOSEPH HEITNER, Automotive Mechanics, Affiliated East West Pvt. Ltd.
2   KIRPAL SINGH, Automobile Engineering. Vol- I & II, Standard Publications. 2006,
3   R. B. GUPTA, Automobile Engineering, Satya Prakashan, New Delhi 1993.

REFERENCES

1   WILLIAM. H. CROUSE, Automotive Mechanics. Mc Graw Hill.
2   BENNET, Engine: Fuel And Computerized Management. 1999.
3   HOLLEMBEAK, Automotive Electricity, Electronics And Computer Control, 1999.
4   NEWTON. K & STEEDS. W. GARRET T. K, Motor Vehicle, Butterworth, IE,1989.
5   R. P. Sharma, A Course in Automobile Engineering, Dhanpat Rai & Sons, 2003.

SANSKRIT & INDIAN CULTURE – V **L T P C**

2 0 0 1

Part- I

Unit I

Temple worship – Evolution of religious establishments; worship in temples; ritual requirements; daily rituals; symbolism of rituals.

Unit II

Temple Festivals – Daily, monthly, yearly, occasionally, etc.; different *vahanas;mudras* in worship; *yajna* and *yajna vedicas* for different sacrifices; other worships and programs related to religious and human welfare.

Part- II

Unit III

Significance of Gandharva veda; Evolution & development of music; Karnataka & Hindustani music; main styles; different famous personalities & their contribution. different early musical instruments.

Unit IV

Evolution & development of dance; different schools; important famous personalities.

Unit V

Different schools and contribution of music, dance and dramas to preserve cultural heritage.

REFERENCE BOOKS

1   Rao, S.R.K. 1992. *Alaya and Aradhana*. Agama-Kosha (Agama Encyclopaedia). Kalpatharu Research Academy Publications. Vol VI. Banglore.
2   Sharma, S. 1997. *Comparative study of Evolution of Music in India and the West*. Pratibha Prakashan. Delhi.
3   Sanyal, R. 1987. *Philosophy of Music*. Somaya Publications Pvt. Ltd. Bombay

PRE-REQUISITE :
Basic knowledge in Mathematics and Reasoning.
AIM:
To enhance the logical reasoning skill and problem solving skills .

OBJECTIVES:
1. To improve numerical skills and diagrammatic reasoning skills.
2. To cater to the needs to attend competitive examinations in a successful manner.

OUTCOMES:
After completion of the course the students are expected to be able to:
1. Solve the problems with verbal understanding
2. Acquire the skill of doing numerical skills and diagrammatic reasoning problems.
3. Acquire the ability to determine the correct sequence of a set of sentences.
4. Do the problems within the time-frame.
5. Attend competitive examinations in a successful manner.

UNIT - I
(NUMBERS AND NUMBER SYSTEMS, EQUATIONS, RATIO-PROPORTION-VARIATION)

Addition-Subtraction-Multiplication-Division-Prime Numbers and Composite Numbers-LCM,HCF-Equations-Variation.

UNIT - II
(PERCENTAGES-PROFIT AND LOSS-PARTNERSHIP,AVERAGES-MIXTURES-ALLIGATIONS AND SIMPLE INTEREST-COMPOUND INTEREST)

Percentage-Partnerships-Average , Mixtures-Alligation, Interest.

UNIT – III
(QUADRATIC EQUATIONS AND PROGRESSIONS,TIME AND WORK-PIPES AND CISTERNS,TIME AND DISTANCE)

Quadratic Equations-Arithmetic progression-Geometric Progression- Time and Work-Pipes and cisterns. Speed.

UNIT - IV
(GEOMETRY-MENSURATION,PERMUTATIONS&COMBINATIONS)

Angles and lines, Arcs and sectors, Mensuration, Permutations, Combinations.

UNIT-V
(PROBABILITY,DATA INTERPRETATION,DATA SUFFICIENCY)

Compound events, Independent events, Methods of Presenting data, Three –dimensional graph, Flow chart.

REFERENCES:

1. *Quantitative Aptitude*, R.S.Aggarwal, S.Chand&Company Pvt.Ltd.,New Delhi.

2. *Quantitative Aptitude for competitive examinations,* Abhijit Guha, Tata McGraw-Hill Education Pvt.Ltd., New Delhi.

ME5P7   **MECHANICAL MEASUREMENTS LABORATORY**   **L T P C**
                                                                 0 0 3 2

METROLOGY LAB

1   Use precision measuring instruments and calibration – Vernier caliper – Vernier height gauge – micrometer (outside) dial gauge and depth gauge
2   Measurement of gear tooth thickness by Gear tooth Vernier
3   Measurements of angles and tapers using bevel tooth protractors, sine bar and sine centers
4   Measuring fundamental dimensions of gear using profile projector
5   Testing squareness of try square using slip gauges
6   Determination of tool angle using tool makers microscope
7   Use of electronic, pneumatic and mechanical comparator for determining – flatness
8   Use of bore gauges or measuring internal diameter
9   Measurement of thread parameters using Floating carriage micrometer
10 Taper and bore measurements using spheres
11 Checking straightness of a surface plate using Autocollimator
12 Measurement of surface roughness using roughness meter.

INSTRUMENTATION

1   Pressure measuring devices – pressure & vacuum gauge calibration
2   Temperature measuring devices – Thermocouples, Resistance thermometer & Thermistor
3   Speed measuring device – Stroboscope, tachometer
4   Force measuring device – load cells, proving rings
5   Torque measuring device – Rope & Prony brake arrangements
6   Strain measurement - strain gauge
7   Displacement measuring device – LVDT
8   Velocity and acceleration measurement – Accelerometer - Piezo electric accelerators
9   Vibration measurement – Vibrometer

DYNAMICS

1   Study of cutting force using lathe/drill tool dynamometer
2   Determination of critical speed of whirling of shaft
3   Static & dynamic balancing of rotors
4   Dynamic balancing of masses using computerised m/c.
5   Determination of M.I by suspension of Simple and compound pendulum method
6   Study of undamped of free vibration of equivalent spring mass system
7   Study of undamped torsional vibrations of single rotor system
8   Porter, Proell and Hartnell Governors
9   Characteristics of Hydrodynamics – journal bearing.
10 Cam and follower analysis.

                                                              TOTAL : 45 PERIODS

ME5P8	**MANUFACTURING TECHNOLOGY LAB**	**L T P C**
		0 0 3 2

FOUNDRY

1 Study of moulding tools, equipment's, and furnaces
2 Preparation of green sand moulding for cubical block, gland, bush, straight pipe, bend pipe, tee- pipe, grooved pulley, involving 2 boxes
3 Sand testings – Permeability, green sand strength and compressibility.
4 Metal casting techniques (demo only)

SMITHY

1 Study of tools and forges
2 Converting a square out of round rod
3 Making L – bend, J- hook, U- clamp
4 Making a square/hexagonal headed bolt

WELDING

1 Exercises in electric arc welding like Butt joint, Lap joint, Tee joint and fillet
2 Gas welding and gas cutting – template cutting
3 MIG and TIG welding

LATHE

1 Study of lathe – types – accessories – capabilities and process – specification
2 Lathe operation – plain & step turning, taper turning, grooving and under
3 cutting,   knurling, thread cutting (single, multistart and internal),
4 eccentric turning
5 Exercise on drilling, reaming, boring & tapping
6 Exercise on capstan lathe/ Turret Lathe.
7 Single point tool grinding using bench grinder (DEMO).

TOTAL : 45 PERIODS

EC5P9   **ELECTRONICS AND MICROPROCESSOR**   **L T P C**
                           LABORATORY

                                                                 0 0 3 2

ANALOG ELECTRONICS

1.   I Characteristics of PN Junction and Zener Diodes.
2.   Input & Output Characteristics of BJT.
3.   Drain & Transfer Characteristics of JFET.
4.   VI Characteristics of UJT / SCR.
5.   Load Regulation Characteristics of Half Wave and Full Wave Rectifier.
6.   Zener Voltage Regulator.
7.   Inverting amplifier / Non Inverting amplifier / Schmitt trigger using IC 741
8.   Instrumentation Amplifier / Astable Multivibrator using IC 741

DIGITAL ELECTRONICS

1.   Study of Logic Gates.
2.   Adder / Subtractor.
3.   Flip Flops - RS/ D / T / JK and Counters.

8085 MICROPROCESSOR

1.   8 – Bit Addition / Subtraction / Multiplication / Division.
2.   Look up table technique / Sort an array in ascending order.
3.   Programming the PPI (8255 IC) in various modes
4.   IO Mode (Interfacing keys, LED's and 7 segment LED)
5.   BSR Mode (Square Wave Generation)
6.   Stepper Motor Interface.
7.   Interfacing ADC/ DAC (Includes Wave form generation)
8.   Interfacing the Traffic Light controller.

                                                        TOTAL : 45 PERIODS

ME6T1   **GAS DYNAMICS & JET PROPULSION**   **L T P C**

                                                                                      3 1 0 3

UNIT - I   **9**

 BASIC CONCEPTS AND ISENTROPIC FLOWS - Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone - Effect of Mach number on compressibility - Isentropic flow through variable area ducts - Nozzle and Diffusers - Use of Gas tables.

UNIT - II   **9**

FLOW THROUGH DUCTS - Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - Variation of flow properties - Use of tables and charts - Generalised gas dynamics.

UNIT - III   **9**

NORMAL AND OBLIQUE SHOCKS **-** Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl - Meyer relations - Use of table and charts - Applications.

UNIT - IV   **9**

JET PROPULSION - Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan & turbo prop engines – Aircraft combustors

UNIT - V   **9**

        SPACE PROPULSION - Types of rocket engines - Propellants - Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity - Applications - Space flights.

                                                                 TOTAL : 45 PERIODS

TEXT BOOK
1.   S.M. Yahya, " Fundamentals of Compressible Flow ", New Age International (P)Limited, New Delhi, 2007.
REFERENCES
1.   P.Hill and C. Peterson, " Mechanics and Thermodynamics of Propulsion, Addison Wesley Publishing Company, 1992.
2.   N.J. Zucrow, " Aircraft and Missile Propulsion, Vol. I & II ", John   Wiley , 1975.
3.   N.J. Zucrow, " Principles of Jet Propulsion and Gas Turbines ", John Wiley, New York, 1970.
4.   H.Cohen, G.E.C.Rogers and Saravanamuttoo, " Gas Turbine Theory Longman Group Ltd., 1980.
5.   G.P.Sutton, " Rocket Propulsion Elements ", John Wiley, 1986,New York.
6.   V.Ganesan, " Gas Turbines ", Tata McGraw Hill Publishing Co., New Delhi, 2008. 2nd Edition.
7.   E. Radhakrishnan, Gas Dynamics, PHI, 2000. 2nd Edition.

ME6T2   **POWER PLANT ENGINEERING**   **L T P C**

                                                                           3 0 0 3

UNIT - I   9

POWER PLANT EQUIPMENT - Essential of steam power plant equipment – power station design – characteristics of steam power plant – layout – Stokers - Types– pulverized fuel firing – principles of FBC – Types of FBC – Arrangement of different FBC plants – advantages of FBC systems – Ash handling – dust collectors – draft measurements – chimneys – calculation of chimney heights – feed water treatment – air preheater – types of superheaters, condenser, cooling towers.

UNIT - II   9

STEAM GENERATORS - Boilers – types of modern high pressure boiler – boiler mountings and accessories – thermal efficiency of boiler – boiler performance – selection of fuel for boiler – boiler maintenance – selection of boiler – heat balance sheet for boiler – Indian boiler act.

UNIT - III   9

POWER PLANT LAYOUTS - Gas turbine power plant layout

Classification or comparison of different types of gas turbine power plants – different arrangements of plant components – governing system for gas turbine power plant.

Diesel power plant layout

Different systems of diesel power plant – advantages & disadvantages of diesel power plant over thermal plant

Hydroelectric power plant layout

Classification – storage reservoir plants – pump storage plants – advantages of hydro-electric power plants.

MHD power plant

UNIT - IV   9

       NUCLEAR POWER PLANT - Nuclear Reactor: General components of nuclear reactors – different types of reactors – pressurized water reactor (PWR), Boiling water reactors (BWR), heavy water cooled and moderated - reactors, gas cooled reactors, liquid metal cooled reactors, fast breeder reactors, location of nuclear power plant, comparison of nuclear power plants with thermal plants. Nuclear materials – fuels – coolant – moderators & reflecting materials – control rod – shielding materials.

UNIT - V   9

       POWER PLANT ECONOMICS - Load curves – different terms & definitions – effect of variable load on power plant design & operation – requirement of peak load plants – fixed or operating cost – load diversion – tariff methods for electrical energy – comparison of economic of different types of power plants – environmental hazards of various power plants.

                                                                    TOTAL : 45 PERIODS

TEXT BOOKS

1.	M. N. EI. WAKIL, Power Plant Technology, Mc Graw Hill, 1985.
2.	ARCHIEW . CULP Jr., Principle of Energy Conversation, Mc Graw Hill.
3.	P. K. NAG, Power Plant Engineering, TMG, 2008.3rd Edition.
4.	G. R. NAGPAL, Power Plant Engineering, Khanna Publishers, 1986.

REFERENCES

1	VOPAL AND STORTZKI, Power Plant Engineering, PHI.
2	DOMKUNDWAR, Power Plant Engineering, Dhanpat Rai & Sons.2007, 5th Edition.
3	JOEL WEISMAN AND ROY ECKART, Morden Power Plant Engineering, PHI
4	G. D. RAI, Non Conventional Sources of Energy, Khanna Publishers, Delhi. 2007, 4th Edition.
5	V. Kadambi, An Introduction to Energy Conversion, New Age Publication Ltd, 2004.

ME6T3   **DESIGN OF MACHINE ELEMENTS**   **L T P C**

                                                                    3 1 0 4

UNIT - I   9

Introduction to design process – factor influencing the machine design, selection of material based on its physical properties. Direct, bending and torsional stress equation, impact and shock loading. Criteria of failure, stress concentration factor, size factor, surface finish factor – factor of safety, design stress, theories of failures – simple problems.

UNIT - II   9

Variable and cyclic loads – fatigue strength and limit, S-N curve, combined cyclic stress, Soderberg and Goodman's equations. Design of helical, leaf, disc, and torsional springs under constant loads and varying loads.

UNIT - III   9

Design of solids and hollow shaft based on strength, rigidity and critical speed. Design and drawing of keys, keyways, coupling-rigid and flexible couplings.

UNIT - IV   9

Design and drawings of welded joints, riveted joints for pressure vessels and structure. Threaded fasteners, cotter joint, knuckle joints, and pipe joints.

UNIT - V   9

Design and drawing of piston, connecting rod, crank shaft and fly wheel

TOTAL : 45 PERIODS

TEXT BOOKS

1. T.V. SUNDARAJAMOORTHY AND SHANMUGAM, Machine Design,
2. JOSEPH EDWARD SHIGHLEY, Mechanical Engineering Design, McGraw Hill. 2008, 8th Edition.
3. R.S. KHURMI & GUPTA JK, A text book of Machine Design, S. Chand & Co.,
4. PANDYA & SHAH, Elements of Machine Design,
5. DONALDSON. C, Tool Design, Tata McGraw Hill & Co.

REFERENCES
1. V. DOBROVOLSKY, Machine Elements, Mir Publication, 1978.
2. A.S. HALL, A.R. HOLOWENKO, AND H.G. LAUGHLIM, Theory And Problems In Machine Design Schaum's series
3. HALL AND ALLEN. S. Machine Design, Schaum's Series. 2008, TMH.
4. M.F. Spolts, Design of Machine Elements, Pearson Eduction, 2005, 7th Edition.
5. Gitin M. Maitra, Hand Book of Mechanical Design, 2nd Edition.
6. J. B. K Das, Design of Machine Elements, Sapna Book House, 2007, 2nd Edition.
7. A. S. Ravindra, Design of Machine Elements, Best Publishers, 2005. 2nd Edition.
8. V. B. Bhandari, Design of Machine Elements, TMH, 2007.

Hand book

Design data book, PSG College of technology, Coimbatore.

(Use of approved data books are permitted in all the examinations)

ME6T4   **COMPUTER AIDED DESIGN**   **L T P C**

                                                                          3 0 0 3

UNIT – I   9

INTRODUCTION TO CAD - Introduction to Design process, Role of Computers in design, types of devices used in design (like display devices, digitizers, light pen, plotter, etc.) and their functions. Various CAD software.

UNIT – II   9

GRAPHICS CONCEPTS (2D & 3D) - Co-ordination System- Transformation, Translation, Scaling, Reflection, Rotation – Concatenated Transformation – Inverse Transformation, Projection – View, Orthographic, Isometric, perspective

UNIT – III   9

VISUALIZATION - windowing, View ports, clipping, Hidden line removal, hidden surface removal, Hidden Solid removal – shading-colouring-rendering-Animation.

UNIT - IV   9

MODELING - Geometric modeling- type- wireframe, Surface and solid Modeling. Solid Modeling Techniques- solid entities, Half-Spaces, Boundary Representation (B-Rep) – C0onstructive Solid Geometry (CSG) – Sweeps- solid Manipulation.

UNIT - V   9

GRAPHICS STANDARDS - Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

                                                              TOTAL : 45 PERIODS

TEXTBOOKS
1.   IBRAHIM ZEID, CAD/CAM, TMH, 2007.
2.   NEWMAN AND SPROULL. R.F, Principles of Interactive Computer Graphics, McGraw Hill.
3.   RADHAKRISHNAN. P, CAD/CAM/CIM, 3st ed. New Central Book Agency, 2008.
4.   KANT VAJPAYEE, Principles of Computers – Integrated Manufacturing, 1st ed. PHI, 1995

REFERENCES
1.   BESANT C.B & LUI.C.N.K, Computer Aided Design and Manufacture, 3rd ed. East West Press.
2.   MIKELL P.GROOVER AND EMORY W.ZIMMERS.Jr., Computer Aided Design and Manufacturing, PHI. 2007.
3.   PETER NINGHAM, CAD systems in Mechanical and Production Engineering, East West Press.
4.   RAO, Features of AutoCad-2000, Wiley
5.   SADHU SINGH, CAD/CAM, Khanna Publishers
6.   Michael E. Mortenson, ” Geometric Modeling “,John Wiley and sons,Inc,1997.
7.   Rogers D.F., Adams J.A.,”Mathematical elements for computer graphics”, McGraw Hill,1976.
8.   Donald Hearn, M. Pauline Baker, ”Computer graphics”, Prentice Hall of India, New Delhi, 1997.

ME6T7   **MECHATRONICS**   **L T P C**

                                                            3 0 0 3

UNIT - I   9
MECHATRONICS, SENSORS AND TRANSDUCERS -Introduction to Mechatronics Systems
– Measurement Systems – Control Systems – Microprocessor based Controllers.
Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position
and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level,
Temperature, Light Sensors – Selection of Sensors

UNIT - II   9
ACTUATION SYSTEMS - Pneumatic and Hydraulic Systems – Directional Control Valves –
Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl
– Belt and Chain Drives – Bearings.
Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C
Motors – A.C Motors – Stepper Motors.

UNIT - III   9
SYSTEM MODELS AND CONTROLLERS - Building blocks of Mechanical, Electrical, Fluid
and Thermal Systems, Rotational – Translational Systems, Electro-Mechanical Systems –
Hydraulic – Mechanical Systems.
Continuous and discrete process Controllers – Control Mode – Two – Step mode –
Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers –
Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

UNIT - IV   9
PROGRAMMING LOGIC CONTROLLERS - Programmable Logic Controllers – Basic
Structure – Memory - Input / Output Processing – Programming – Mnemonics – Timers,
Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling –
Analogs Input / Output – Selection of a PLC – PLC Applications

UNIT - V   9
DESIGN OF MECHATRONICS SYSTEM **-** Stages in designing Mechatronics Systems –
Traditional and Mechatronics Design - Possible Design Solutions
Case Studies of Mechatronics Systems, Pick and place robot – automatic Car Park Systems –
Engine Management Systems Automatic Camera, Washing machine.

                                                    TOTAL : 45 PERIODS

TEXT BOOKS

1.   W. Bolton, "Mechatronics", Pearson Education, 3rd Edition, 2007.
2.   HMT Ltd, Mechatronics, TMH, 2007.

REFERENCES

1.   Michael B. Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2007. 3rd Edition
2.   Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3.   Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
4.   Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering", An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
5.   Nitaigour Premchand Mahadik, "Mechatronics", Tata McGraw-Hill publishing Company Ltd, 2003
6.   Prof. C. R. Venkataramana, Mechatronics, Sapna Book House, 2003.

ME6T6   PRODUCTION AND OPERATION MANAGEMENT   L T P C
3 0 0 3

OBJECTIVES

To understand the various components and functions of production Management, process planning, production scheduling, Inventory Control and use of management tool

UNIT - I INTRODUCTION   9

Functional sub systems of organizations, Systems concept of production, Types of production systems, Productivity, Strategic management. New product development, Process Planning and Design, Value analysis and Value Engineering, Standardization, Simplification, Ergonomic considerations in Product design.

UNIT - II FORECASTING AND FACILITY LOCATION AND LAYOUT   9

Forecasting: Introduction, Nature and use of forecasting, Measures of Forecasting, factors affecting forecasting, Types and models of forecasting. Facility Location and Lay out: Factors influencing plant location, location evaluation methods, Different types of lay outs for operations and production, arrangement of facilities within the department.

UNIT - III MASTER PRODUCTION SCHEDULING AND INVENTORY CONTROL   9

Aggregate Planning and Master Production Scheduling: Nature of aggregate planning, Methods of aggregate planning, Approaches to aggregate planning - graphical, empirical and optimization, Development of MPS, MRPI and MRPII. introduction to Inventory Analysis and Control: Definitions, ABC inventory systems,

UNIT - IV SCHEDULING AND PROJECT MANAGEMENT 9

Scheduling and Controlling: Objectives in scheduling, Major steps involved, Production control in repetitive, batch / flow shop and job shop scheduling environment - SPT, EDD, WMFT. Project Planning and Management: Phases of project management, Evolution of network planning techniques.

UNIT - V MODERN PRODUCTION MANAGEMENT TOOLS   9

Just in Time (JIT) - Introduction, elements, pull and push method, KANBAN systems, Small lot size, quick inexpensive set up, Continuous improvement, optimized production technology, CIM and FMS, Benefits and Scope of TQM, Factors affecting quality and Quality control activities in product cycle and ISO 9000 series - Scope and Benefits

TOTAL: 45 PERIODS
OUTCOMES:

Upon completion of this course, the students can able to prepare process planning, production scheduling, Inventory Control and use of management tool

TEXTBOOKS
1. PANNEERSELVAM. R., 'Production and Operations Management', Prentice Hall India, 2001

REFERENCE BOOKS
1. VOLLMAN.T.E., 'Manufacturing Planning & Control Systems', Galgotia publication (p) ltd, New Delhi, 1998
2. DILWORTH. B. JAMES., 'Operations Management - Design, Planning and Control for Manufacturing and services', Mc Graw Hill Inc., New Delhi, 1992
3. BEDWORTH D.D., 'Integrated Production Control Systems' - Management, Analysis, Design, John Wiley & sons, New York, 1982

Part - I

Unit I

Art forms as cultural expression; technology & aesthetics; their relation to the social structure.

Unit II

Evolution of religious structures & architecture in Indian; different early schools and art centers; important other secular structures.

Unit III

Development of regional styles in Indian art & architecture; important features of Nagara, Dravida & Vesara styles in temple architecture. Sculpture, Iconography and Paintings – different centers and contribution on Indian culture.

Part - II

Unit IV

Significance of Stapatya veda; Silpa and Vastu Sastra – significance of vastu in architecture. Vishvakarma, Mayamata, Manasara, Samarangana, Stapatya, etc., personalities and their contribution in Indian Architecture.

Unit V

The decorative art & craft; precious stones & metal; textiles & carpets; calligraphy & other important works;

REFERENCE BOOKS

1   Banerji, J.N. 1941. *The Development of Hindu Iconography*. University of Calcutta. Calcutta.
2   Gopinath Rao, T.R. 1914. *Elements of Hindu Iconography*. Vol I & II.
3   Meister, M.W. (ed) 1983. *Encyclopaedia of Indian Temple Architecture.* American Indstitute of Indian Studies. University of Pennsylvania Press. Philadelphia.
4   Sukla, D.N. 1993. *Vastu-Sastra. Hindu Science of Architecture*. Munshiram Manoharlal Publishers Pvt. Ltd. New Delhi.

HR6T4	HR SKILLS – IV	L T P C
	APTITUTE SKILLS-II	
		1 1 0 1

PRE-REQUISITE :
Basic knowledge in Mathematics and Reasoning.

AIM :
To succeed in campus recruitment and other career development examinations.

OBJECTIVES :
1. To improve candidate does abilities and verbal understand.
2. To improve numerical skills and diagrammatic reasoning skills.
3. To help to determine the correct sequence of a set of sentences.
4. Totrain the students to identify from a number of pieces of   information, those that are needed to solve a problem.
5. To cater to the needs to attend competitive examinations in a successful manner.

OUTCOMES:
After completion of the course the students are expected to be able to:
1. Solve the problems with verbal understanding
2. Acquire the skill of doing numerical skills and diagrammatic reasoning problems.
3. Acquire the ability to determine the correct sequence of a set of sentences.
4. Do the problems within the time-frame.
5. Attend competitive examinations in a successful manner.

UNIT- I (NUMBERS AND LETTER SERIES - ANALOGIES)

Number series –Difference series – Product series – Squares/ cube series – combination series – General approach to number series. Letter series – Number and Letter analogies.

UNIT- II (CODING AND DECODING – BLOOD RELATION)

Coding and Decoding – Odd man out – Alphabet classification – Word classification – Number classification. Blood Relation.

UNIT – III (DIRECTIONAL SENSE – SYMBOLS AND NOTATION - DEDUCTION)

Directional sense - Symbols and Notation – Blood relation – Mathematical operations – Deduction – Rules of deduction – Example (I to X)

UNIT- IV
(CONNECTIVITY'S – CLOCK AND CALENDARS – ANALYTICAL REASON)

Connectivity's – Logical Connectivity's – OR, NOT, AND, IF-THEN. Clock – Points to note. Calendars –Leap& non Leap year – Counting number of odd days - Analytical reason – Linear sequencing – Circular arrangements – Order sequence.

UNIT- V
(DISTRIBUTION – BINARY LOGIC & PUZZLES – CUBES & VENN DIAGRAMS – NON-VERBAL REASONING)

Distribution – Double line distribution – Binary logic - Puzzle. Cubes – Venn diagram Type I, II, III – Non-Verbal reasoning – Patterns of behavior elements – Types of questions

REFERENCES :
1. *Quantitative Aptitude,* R.S.Aggarwal, S.Chand & Company Pvt. Ltd., New Delhi.
2. *Quantitative Aptitute for competitive examinations*, Abhijit Guha, Tata McGraw-Hill Education Pvt. Ltd., New Delhi.

ME6P7   **HEAT TRANSFER LABORATORY**   **L T P C**

                                                          0 0 3 2

LIST OF EXPERIMENTS

1.   Thermal conductivity of insulating powder
2.   Heat transfer through composite wall
3.   Heat transfer under natural convection
4.   Heat transfer under forced convection
5.   Heat transfer through a pin fin
6.   Parallel / counter flow heat exchanger
7.   Stefan – Boltzman apparatus
8.   Thermal conductivity of metal bar
9.   Emissivity measurement
10. Heat transfer through lagged pipe
11. Performance analysis of vapour Compression Refrigeration system
12. Performance analysis of cooling tower
13. Shell & tube Heat Exchanger
14. Recirculation Type A/c.
15. Dropwise and Flimwise condensation

                                              TOTAL : 45 PERIODS

ME6P8   **SPECIAL MACHINES LAB**   **L T P C**

                                                       0 0 3 2

LIST OF EXPERIMENTS

1.   Machining of plane and inclined surfaces, grooving, dovetail cutting using shaping machine
2.   Cutting of spur, helical, bevel gear and milling of polygon surface using milling machine
3.   Making of spur gear using gear Hobbing machine
4.   Making of helical gear using gear Hobbing machine
5.   Cutting of keyway (internal & external) using slotting machine
6.   Exercises involving cylindrical grinder
7.   Exercises involving surface grinder
8.   Exercises involving tool & cutter grinder
9.   Exercises involving center less grinder.

                                              TOTAL : 45 PERIODS

ME6P9   **CAD / CAM LABORATORY**   **L T P C**

                                                           0 0 3 2

OBJECTIVES:

• To gain practical experience in handling 2D drafting and 3D modelling software systems.
• To study the features of CNC Machine Tool.
• To expose students to modern control systems (Fanuc, Siemens etc.,)
• To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

1. 3-D GEOMETRIC MODELLING   **24- PERIODS**

Creation of 3-D assembly model of following machine elements using 3-D Modelling software

Introduction of 3D Modelling software

LIST OF EXERCISES

1. Flange Coupling
2. Plummer Block
3. Screw Jack
4. Universal Joint
5. Connecting rod
6. Piston

2. MANUAL PART PROGRAMMING.   **21 PERIODS**

(i) Part Programming - CNC Machining Centre

1. Linear Cutting
2. Circular cutting
3. Cutter Radius Compensation
4. Canned Cycle Operations

(ii) Part Programming - CNC Turning Centre

1. Straight, Taper and Radius Turning
2. Thread Cutting
3. Rough and Finish Turning Cycle
4. Drilling and Tapping Cycle

                                        TOTAL: 45 PERIODS

INDUSTRIAL TRAINING **L T P C**
0 0 0 1

OBJECTIVE:
• The main objective of the Industrial Training is to experience and understand real life situations in industrial organizations and their related environments and accelerating the learning process of how student's knowledge could be used in a realistic way.

DURATION:
The students have to undergo practical industrial training for 1 t o 2 weeks (During Semester holidays) in recognized industrial establishments.

I. At the end of the training they have to submit a report with following
   1. Profile of the Industry
   2. Product range
   3. Organization structure
   4. Plant layout
   5. Processes/Machines/Equipment/devices
   6. Personnel welfare schemes
   7. Details of the training undergone
   8. Projects undertaken during the training, if any
   9. Learning points.
II. End Semester examination will be a Viva-Voce Examination.

MD7T1   OPERATIONS RESEARCH   **L T P C**

                                                                                      3 1 0 3

UNIT- I LINEAR PROGRAMMING AND SIMPLEX METHOD   9

Mathematical formulation of the problem - Graphical solution method - Exceptional cases - General linear programming problem - Canonical and standard forms of linear programming problem - The simplex method - Computational procedure : The simplex algorithm - Artificial variable techniques : Big M method, Two phase method - problem of degeneracy.

UNIT - II TRANSPORTATION, ASSIGNMENT AND ROUTING PROBLEMS   9

Mathematical formulation of the transportation problem - Triangular basis - Loops in a transportation table - Finding initial basic feasible solution (NWC, IBM and VAM methods) - Moving towards optimality - Degeneracy in transportation problems- Transportation algorithm (MODI method) - Unbalanced transportation problems - Mathematical formulation of the assignment problem - Assignment algorithm : Hungarian assignment method - Routing problems : Travelling salesman problem.

UNIT- III GAME THEORY AND SEQUENCING PROBLEMS   9

Two person zero sum games - Maxmin Minmax principle - Games without saddle points (Mixed strategies) - Solution of 2 X 2 rectangular games - Graphical method - Dominance property - Algebraic method for m x n games - Matrix oddments method for m x n games - Problem of sequencing - Problems with n jobs and 2 machines - Problems with n jobs and k machines - Problems with 2 jobs and k machines.

UNIT - IV INTEGER PROGRAMMING AND INVENTORY CONTROL   9

Gomory's All I.P.P method - Gomory's mixed integer method - Branch and bound method - Reasons for carrying inventory - Types of inventory - Inventory decisions - Economic order quantity - Deterministic inventory problem - EOQ problem with price breaks - Multi item deterministic problem.

UNIT - V REPLACEMENT PROBLEMS AND PERT/CPM   9

Replacement of equipment or asset that deteriorates gradually - Replacement of equipment that fails suddenly - Recruitment and promotion problem - Network and basic components - Rules of network construction - Time calculations in networks - Critical path method (CPM) - PERT - PERT calculations - Negative float and negative Slack - Advantages of network (PERT/CPM).

TEXT BOOK
1   Kanti Swarup, P.K.Gupta and Man Mohan, Operations Research, Eighth Edition, Sultan Chand & Sons, New Delhi, 1999.
    REFERENCES

1   H.A.Taha, Operations Research, Sixth Edition, MacMillen.
2   Richard Bronson, Operations Research, (Schaum's Outline Series, McGraw Hill Company, 1982.
3   J.K.Sharma, Operation Research (Theory and Applications), Mac Millen Ltd., 1997

ME7T2   **COMPUTER INTEGRATED MANUFACTURING**   **L T P C**

                                                      3 0 0 3

OBJECTIVES

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Numerical Control and Flexible Manufacturing System

UNIT - I   INTRODUCTION TO AUTOMATION
        9

Production system Facilities, Manufacturing Support Systems, Automation in Production Systems, Automated Manufacturing Systems, Types of Automation, Computerized manufacturing Support System, Reasons for Automating, Manufacturing Industries and Products, Manufacturing operations, Product / Production Relationships, Production Concepts and Mathematical Models. Basic elements of an Automated System, Advanced Automation Functions, Levels of Automation.

UNIT – II   FUNDAMENTALS OF COMPUTER INTEGRATED MANUFACTURING   9

Fundamentals of CAD, CAM and CAE, CIM Definition, CIM Wheel, CIM components, Evolution of CIM - Development of computers - Needs of CIM, Benefits of CIM. CIM Hardware & Software, CIM Models.
DBMS and Network system - Data base and DBMS- requirement, features and architecture of DBMS. CIM Communications (Network) System, Communication Matrix, Network Architectures, Tools and Techniques.

UNIT - III   PROCESS PLANNING   9

Structure of a Process Planning, Process Planning function, CAPP - Types of CAPP, Retrieval and Generative type CAPP, Concurrent engineering, Design for Manufacturing and Assembly, Advanced Manufacturing Planning.
Group Technology – Introduction - coding and classification system, Production Flow Analysis, Coding System - OPTIZ, MICLASS, Benefits of Group Technology, Machine cell design.

UNIT – IV   FUNDAMENTALS OF NUMARICAL CONTROL TECHNOLOGY   9

Basic components of an NC System, NC Coordinate and Motion Control systems, Computer Numerical Control, Features of CNC, Machine Control Unit for CNC, CNC Software, DNC Machines, Application of NC machine tools Applications, Structure of CNC Machines, CNC Controllers, NC Part Programming, Computer-Assisted Part Programming.

UNIT - V   FLEXIABLE MANUFACTURING SYSTEM   9

FMS -Components of FMS, Computer control and function, FMS planning, scheduling and control, Knowledge Based Scheduling, FMS operation control, Hierarchy of computer control, supervisory control, types of software used in FMS, Applications and Benefits. Shop floor control and its modules
Developments in Manufacturing Technologies- AI and Expert System, Agile manufacturing, Lean Manufacturing, Virtual Manufacturing, Simulation in Manufacturing.

                                                            TOTAL: 45 PERIODS

OUTCOMES

- Upon completion of this course, the student can able to understand the use of computers in process planning and use of FMS in CIM

TEXT BOOKS

1. KANT VAJPAYEE.S, Principles of Computer- Integrated Manufacturing; 1st ed. PHI 2006.
2. MIKELL P. GROOVER, Automation, Production Systems & CIM, 2nd ed. PHI 2001.
3. JAMES A.REHG, Henry W.Kraebber, Computer- Integrated Manufacturing, second Edition, Pearson Education.
4. P.N. RAO, CAD/CAM Principles and Applications Second Edition, TMH 2006.

REFERENCE BOOKS

1. RADHAKRISHNAN.P, SUBRAMANYAN. S, RAJU.V, 'CAD/CAM/CIM', Second Edition, New Age International publishers, 2000
2. DANIEL HUNT.V., 'Computer Integrated Manufacturing Hand Book', Chapman & Hall, 1989
3. GROOVER M.P, 'Computer Aided Design and Manufacturing', Prentice Hall of India, 1987
4. YOREM KOREN, 'Computer Control of Manufacturing System', McGraw Hill, 1986
5. Ranky Paul. G., 'Computer Integrated Manufacturing', Prentice Hall International, 1986.
6. ROGER MANNAM, Computer Integrated Manufacturing from Concepts of Realization 1st ed. Addison Wiley, 1997.
7. P. N. RAO, Computer Aided Manufacturing, TMH, 2007, 12th Edition.

UNIT - I   **9**
INTRODUCTION - Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

UNIT - II   **9**
ONE   DIMENSIONAL   PROBLEMS - Finite element modeling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNIT - III   **9**
TWO   DIMENSIONAL   CONTINUUM **-** Introduction – Finite element modelling – Scalar valued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation – Temperature effects

UNIT - IV   **9**
AXISYMMETRIC   CONTINUUM - Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs

UNIT - V   **9**
ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM   **-** The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

                                                                        TOTAL : 45 PERIODS

TEXT BOOKS
1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", Pearson Education 2002, 3rd Edition.
2. David V Hutton "Fundamentals of Finite Element Analysis"2004. McGraw-Hill Int. Ed.
3. Rao S.S., "The Finite Element Method in Engineering", Pergammon Press, 1989

REFERENCES
1. Logan D.L., "A First course in the Finite Element Method", Third Edition, Thomson Learning, 2002.
2. Robert D.Cook., David.S, Malkucs Michael E Plesha, "Concepts and Applications of Finite Element Analysis" 4 Ed. Wiley, 2003.
3. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill International Student Edition, 1985
4. O.C.Zienkiewicz and R.L.Taylor, "The Finite Element Methods, Vol.1", "The basic formulation and linear problems, Vol.1", Butterworth Heineman, 5th Edition, 2000.
5. C. S. Krishnamoorthy, Finite Element Analysis, TMH, 2007, 2nd Edition.
6. K. J. Bathe, Finite Element Procedures, PHI, 2006,
7. Desai/ Abel, Introduction to Finite Element Method, CBS Publishers, 2005.
8. S. M. Murigendrappa, Fundamental of Finite Element Method, Interline Publishing, 2006.

ME7T4   **DESIGN OF TRANSMISSION SYSTEMS**   **L T P C**

                                                                    3 1 0 4

UNIT – I   9

BEARINGS AND DRIVES - Design of sliding contact bearings using Summerfield number – design using Mckee's equation, selection of rolling contact bearing for radial and axial load combination and for varying load cycles.

Design of flat belts and 'V' belts using manufacturer's data, introduction to continuously variable speed transmission, design of step cone pulley, design of chain drives, design of hoisting and hauling ropes.

UNIT- II   9

BRAKES, SCREWS AND CAMS - Design of clutches – Various service factors – dry and wet clutches, design of brakes - heat generation and dissipation in brakes – force analysis in drum brakes with external shoes – permissible bearing pressure – selection of brake material – braking power – power absorbed - bearing load calculations – width of shoe, design of band brakes – simple and differential type – width and thickness design. Introduction to design of disk brakes – brake lining fade.

Design of cams for parabolic, SHM, and cycloid follower motions, undercutting in cams – torque required to drive cams – polynomial motion cams – cam size determination – inertia force calculation – contact stress calculation.

UNIT - III   9

DESIGN OF SPUR AND HELICAL GEARS - Design of spur and helical gears – design of Geneva wheel mechanism, power rating calculations based on strength and wear considerations – gear tooth correction.

UNIT - IV   9

DESIGN OF POWER SCREWS - Design of power screws – wear and strength considerations – design of lead screws for machine tools, design of screw jacks and toggle jacks. Design of bevel and worm gears, design of Ratchet and Pawl mechanism

UNIT - V   9

MULTI SPEED GEAR BOXES - Design of speed reducers, design of multi speed gearboxes for Automobile - machine tools, structural and ray diagrams.

TOTAL : 45 PERIODS

TEXT BOOKS

1.   PRABHU. T.J. Design of Transmission Elements.
2.   SUNDARARAJAMURTHY.T.V AND SHANMUGAM, Machine Design, Khanna Publishers.
3.   JOSEPH EDWARD SHIGHLEY, Mechanical Engineering Design, McGraw Hill. 2008, 8th Edition.
4.   R.S. KHURMI & GUPTA JK, A text book of Machine Design, S. Chand & Co.,
5.   PANDYA & SHAH, Elements of Machine Design,
6.   DONALDSON. C, Tool Design, Tata McGraw Hill & Co.

REFERENCE BOOKS
1.   V. DOBROVOLSKY, Machine Elements, Mir Publication, 1978.
2.   SHIGLEY, Mechanical Engineering Design, McGraw Hill.
3.   PANDYA AND SHAH, Elements of Machine Design.
4.   MAITRA, Handbook of Gear Design, Tata McGraw Hill.
5.   A.S. HALL, A.R. HOLOWENKO, AND H.G. LAUGHLIM, Theory And Problems In Machine Design Schaum's series
6.   HALL AND ALLEN. S. Machine Design, Schaum's Series. 2008, TMH.
7.   M.F. Spolts, Design of Machine Elements, Pearson Eduction, 2005, 7th Edition.
8.   Gitin M. Maitra, Hand Book of Mechanical Design, 2nd Edition.
9.   J. B. K Das, Design of Machine Elements, Sapna Book House, 2007, 2nd Edition.
10.   A. S. Ravindra, Design of Machine Elements, Best Publishers, 2005. 2nd Edition.
11.   V. B. Bhandari, Design of Machine Elements, TMH, 2007.
12.   A.S.HOLOWENKO, A.R., AND LAUGHLIN H.G Theory and problems in Machine Design, Hall, Schaum series.

Hand book

Design data book, PSG College of technology, Coimbatore.

(Use of approved data books are permitted in all the examinations)

ME7T5   **FLUID POWER SYSTEMS**   **L T P C**

                                                                             3 0 0 3

UNIT - I   9

INTRODUCTION - Introduction to fluid power – review of fundamentals principles of fluid power – construction, operation and characteristics of gear pump, vane pump, variable displacement pump, piston pump. Fluid power actuators – linear and rotary – computation of force – flow requirements – cushioning – cylinder mountings – relatives merits – selection criteria for specific application – power pack design.

UNIT - II   9

CONTROL SYSTEM COMPONENTS AND ACCESSORIES **-** Valves – non return valve for pressure control, direction control and flow control – servo valves and proportional control valves – valve actuation techniques – pressure, electrical, limit switch or sensor based. Relief valve- brake valve – counter balance valve. Fluid power maintenance – filter – seals- reservoirs. Selection of accumulator, hoses and couplings – safety regulation as per BIS.

UNIT - III   9

HYDRAULIC CIRCUITS **-** Fluid power symbols, hydraulic circuit – regenerative – intensifier – metering out – bleed off. Design of circuits for specific applications – Vehicle suspension system – hydraulic press – low cost automation. Programmable logic control. Electrical control for fluid power circuits, Temperature control in Hydraulic circuits.

UNIT - IV   9

HYDRAULIC CIRCUIT DESIGN - Design of circuits and selection of components with specification for the following applications – hydraulic or pneumatic system for shapers – lift hydraulic press – automatic reciprocating system – shock absorber – conveyor feed system – hydraulic cranes and earth moving equipment's.

UNIT - V   9

PNEUMATIC SYSTEMS - Basic principles of pneumatic circuits – merits and demerits over hydraulic system, pneumatic conditioners – filters – regulators – lubricator – mufflers – air dryers. Types of air compressed – pneumatic actuators – control of pneumatic circuits – valves. Introduction to pneumatic logic controls- pneumo-hydraulic circuits.

                                                     TOTAL : 45 PERIODS

TEXTBOOKS

1.   ANTHONY ESPOSITO, Fluid Power with Applications, Prentice Hall, 1980
2.   PIPPENGER, Industrial Hydraulics, TMH

REFERENCES

1.   PRINCHES. M.J. & ASHBY JOHN, Power Hydraulics, Prentice Hall, 1989
2.   SULLIIVAN JAMES .P, Fluid Power Theory and Application, Prentice Hall.

ME7P8   **MECHATRONICS LABORATORY**   **L T P C**

                                                             0 0 3 2

LIST OF EXPERIMENTS

1. Design and testing of fluid power circuits to control

   (i) velocity (ii) direction and (iii) force of single and double acting actuators

2. Design of circuits with logic sequence using Electro pneumatic trainer kits.

3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using

   software.

4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.

5. Servo controller interfacing for open loop

6. Servo controller interfacing for closed loop

7. PID controller interfacing

8. Stepper motor interfacing with 8051 Micro controller

   (i) full step resolution (ii) half step resolution

9. Computerized data logging system with control for process variables like

   pressure flow and temperature.

<div align="right">TOTAL : 45 PERIODS</div>

ME7P9	COMPUTER AIDED ANALYSIS LABORATORY	L T P C
		0 0 3 2

AIM: To acquire the skills needed to analyze and simulate engineering systems.

OBJECTIVES:

- To give exposure to software tools needed to analyse engineering systems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXERCISES

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi – symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.

TOTAL : 45 PERIODS

ME7Z1	PROJECT WORK PHASE - I	L T P C
		0 0 4 2

The project work Phase –I involves the following:

- Identification of a real life problem in thrust areas
- Finalisation of system requirements and specification
- Proposing different solutions for the problem based on literature survey
- Future trends in providing alternate solutions
- Submission of Consolidated report prepared
- Presentation of the above work with viva-voce

SOFT SKILLS** **L T P C**
0 0 3 1

OBJECTIVES

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations

    1 Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
    2 Creating effective PPTs – presenting the visuals effectively
    3 Using appropriate body language in professional contexts – gestures, facial expressions, etc.
    4 Preparing job applications - writing covering letter and résumé
    5 Applying for jobs online - email etiquette
    6 Participating in group discussions – understanding group dynamics - brainstorming the topic
    7 Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD
    8 Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
    9 Attending job interviews – answering questions confidently
    10 Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

REFERENCE BOOKS:

1 Dhanavel, S.P. 2010. *English and Soft Skills.* Hyderabad: Orient BlackSwan Ltd.
2 Corneilssen, Joep. *How to Prepare for Group Discussion and Interview.* New Delhi: Tata-McGraw-Hill, 2009.
3 D'Abreo, Desmond A. *Group Discussion and Team Building.* Mumbai: Better Yourself
4 Books, 2004.
5 Ramesh, Gopalswamy, and Mahadevan Ramesh. *The ACE of Soft Skills.* New Delhi: Pearson, 2010.
6 Gulati, Sarvesh. *Corporate Soft Skills.* New Delhi: Rupa and Co. 2006.
7 Van Emden, Joan, and Lucinda Becker. *Presentation Skills for Students.* New York: Palgrave Macmillan, 2004.

WEB RESOURCES

1. www.humanresources.about.com
2. www.careerride.com

ME8T1　　　　**PRINCIPLES OF INDUSTRIAL MANAGEMENT**　　　**L T P C**

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3 0 0 3

UNIT - I　　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
MANAGEMENT AND ITS ENVIRONMENT - Management – definition – functions, evolution of modern management, scientific management movement, development of management thoughts, different schools of management, forms of organization – individual ownership – partnership – companies – public sector undertakings, corporate framework – share holders – board of directors – committees – chief executive – line and functional managers, constraints – environmental – financial – legal – trade unions – technology - cooperative enterprises.

UNIT - II　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
MANAGEMENT OF ORGANISATION - Planning – nature and purpose – objectives – strategies – policies and planing premises – decision making, Organising - nature and process – premises – departmentalization – line and staff – decentralisation – organisational culture, Staffing – selection and training – placement – performance appraisal – career strategy, Leading – managing human factor – motivation, leadership – communication, Controlling – system and process of controlling – controlling techniques.

UNIT - III　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
Industrial Behavior - Organisational behavior – definition – managerial role and functions – organisational approaches, individual behavior – causes – environmental effect – behavior and performance, perception – organisational implications, personality – contributing factors – dimension - motivation – need theories – process theories – job satisfaction, learning and behavior – learning curves, work design and approaches.

UNIT - IV　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
GROUP BEHAVIOR - Groups – contributing factors – group norms, communication – process – barriers to communication – effective communication, managerial grid – leadership styles – group decision making – leadership role in group decision, group conflict.
Formal and informal – organisational structures, organisational change and development – change process – resistance to change – O.D. programme – culture and ethics.

UNIT - V　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
MODERN MANAGEMENT CONCEPTS - Management by objectives (MBO) – Principles and steps – advantages and disadvantages, management by exception (MBE), strategic management, planning for future direction – SWOT analysis – evolving development strategies, information technology in management – decision support systems –electronic commerce/business, newer concepts – business process reengineering (BPR) - enterprise resource planning (ERP) – supply chain management (SCM) – activity based management (ABM).

　　　　　　　　　　　　　　　　　　　　　　　　　　　TOTAL: 45 PERIODS

TEXTBOOKS

1.　　HARROLD KOONTZ AND HEINZ WEIHRICH, Essentials Of Management, Mc Graw Hill

REFERENCES

1.　　Jit. S. CHANDRAN, Organisational Behaviors, Vikas publishing House Pvt. Ltd., New Delhi

2.　　ERNEST DALE, Management Theory And Practice, International edition, Mc Graw Hill.

TOTAL QUALITY MANAGEMENT **L T P C**

3 0 0 3

UNIT - I 9

INTRODUCTION - Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT - II 9

TQM PRINCIPLES - Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT - III 9

TQM TOOLS - Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT- IV 9

QUALITY SYSTEMS - Quality Auditing - Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

UNIT - V 9

STATISTICAL PROCESS CONTROL (SPC) - The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

TOTAL: 45 PERIODS

TEXT BOOK

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES

1. James R.Evans & William M.Lidsay, "The Management and Control of Quality", (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 1996.
4. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.

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The project work Phase –II involves the following:

- Implementation of Phase - I
- Testing & Validation of the developed system
- Learning in the Project
- Submission of Consolidated final project report
- Presentation of the above work with viva-voce

ME7E1   **ENERGY CONSERVATION IN INDUSTRIES**   **L T P C**

                                                          3 0 0 3

OBJECTIVES:

At the end of the course, the student is expected to

- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I   INTRODUCTION   8

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II   ELECTRICAL SYSTEMS   12

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT III   THERMAL SYSTEMS   12

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam:Distribution &Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV   ENERGY CONSERVATION IN MAJOR UTILITIES   8

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V   ECONOMICS   5

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: 45 PERIODS

TEXT BOOK:

1.   Energy Manager Training Manual(4 Volumes) available at www.energymanagertraining. com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004.

REFERENCES:

1 L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" HemispherePubl, Washington, 1988.
2 Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
3 I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London, 1982
4 W.C. turner, "Energy Management Hand book" Wiley, New York, 1982.
5 W.R. Murphy and G. Mc KAY "Energy Management" Butterworths, London 1987.

UNIT -I   9
PLANT LOCATION & PHYSICAL FACILITIES - Introduction - Factors to be considered - Selection of plant site -Consideration in facilities planning and layout – Installation and implementation of layout

Equipment required for plant operation - Classification of equipment - Main factors for selection of equipment - Capacity Integration of equipment and capacity – Serviceability – Flexibility - Analysis in selection of equipment - Space requirements - Man Power Requirements.

UNIT- II   9
PLANT LAYOUT - Introduction - Need for Layout – Factors influencing Plant Layout – Product or Line Layout - Process or Functional Layout – Fixed Position Layout – Combination Layout – Tools and Techniques for developing Layout – Process Chart – Flow Diagram – String Diagram – Template – Scale models – Layout Planning Procedure – Visualization of Layout – Revision and improving existing Layout - Line balancing – Fabrication line balancing – Assembly Line balancing.

UNIT -III   9
MATERIAL HANDLING **-** Introduction – Importance – Scope – Principles of Material handling – Planning Principle – Operation Principle – Equipment Principle – Costing Principle – Types of Material Handling System – Factors Influencing the Selection of Material Handling Devices – Common Material Handling Devices in use – Specification of material handling equipment

UNIT - IV   9
ANALYSIS OF MATERIAL HANDLING & PACKAGING **-** Factors involved – Motion Analysis – Safety Analysis – Need for Safety – Equipment – Cost analysis – Palletization Analysis – Analysis of operation – Material Handling Surveys – Need for Survey – Types of Surveys - Reasons for Bad Material Handling.

Packing of Material – Importance of Packaging – Layout of Packaging – Package Machineries – Types – Wrapping and Packing of Materials – Cushion Materials.

UNIT - V   9
        MATERIAL HANDLING SYSTEM - Flexible hoisting appliances like ropes and chains- welded load chains- roller chains- selection of chains hemp rope and steel wire rope- selection of ropes- fastening of chains and ropes- different types of load suspension appliances- fixed and movable pulleys- different types of pulley systems- multiple pulley systems- chain and rope sheaves and sprockets

                                                            TOTAL : 45 PERIODS

TEXT BOOK
1.   James M Apple "Plant Layout And Material Handling" John Willey & Sons, New york, Third Edition, 1983.

REFERENCE
1.   Mikell .p. Groover "Automation Production System and Computer Integrated Manufacturing", Prentice Hall of India Pvt. Ltd, First edition, 1987
2.   Govindan K.R. "Plant Layout And Material Handling", Anuradha Agencies, First Edition, 1997

ME7E3   **COMPOSITE MATERIALS**   **L T P C**

                                                              3 0 0 3

UNIT- I   9

INTRODUCTION TO COMPOSITES - Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNIT -II   9

POLYMER MATRIX COMPOSITES - Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

UNIT -III   9

METAL MATRIX COMPOSITES - Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

UNIT – IV   9

CERAMIC MATRIX COMPOSITES - Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT- V   9

ADVANCES IN COMPOSITES **-** Carbon / Carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications – Introduction to Nano composite.

Various Testing procedures for composite materials - environmental recycling of composite materials.

TEXT BOOKS

1.   Mathews F.L. and Rawlings R.D., "Composite materials: Engineering and Science", Chapman and Hall, London, England, 1st edition, 1994.
2.   Chawla K.K., "Composite materials", Springer – Verlag, 1987

REFERENCES

1.   Clyne T.W. and Withers P.J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
2.   Strong A.B., "Fundamentals of Composite Manufacturing", SME, 1989.
3.   Sharma S.C., "Composite materials", Narosa Publications, 2000.
4.   "Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy", IIT- Madras, December 2001.

5.   Madhu jit Mukho Padhyay, Mechanics of Composite Materials and Structures, University Press, 2004.

ME7E4   QUALITY CONTROL AND RELIABILITY ENGINEERING   **L T P C**
                                                                                 3 0 0 3

UNIT- I   **9**
INTRODUCTION AND PROCESS CONTROL FOR VARIABLES -Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors – process capability – process capability studies and simple problems – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart – six sigma concept.

UNIT- II   **9**
PROCESS CONTROL FOR ATTRIBUTES - Control chart for attributes –control chart for proportion or fraction defectives – p chart and np chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

UNIT- III   **9**
ACCEPTANCE SAMPLING - Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT - IV   **9**
LIFE TESTING – RELIABILITY - Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT -V   **9**
QUALITY AND RELIABLITY - Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Note : Use of approved statistical table permitted in the examination.

TEXT BOOKS
1.   GRANT, EUGENE.L "Statistical Quality Control", McGraw-Hill, 1996.
2.   L.S.SRINATH, "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES
1.   MONOHAR MAHAJAN, "Statistical Quality Control", Dhanpat Rai & Sons,2001.
2.   R.C.GUPTA, "Statistical Quality control", Khanna Publishers, 1997.
3.   BESTERFIELD D.H., "Quality Control", Prentice Hall, 1993.
4.   SHARMA S.C., "Inspection Quality Control and Reliability", Khanna Publishers,1998.
5.   DANNY SAMSON, "Manufacturing & Operations Strategy", Prentice Hall, 1991
6.   CONNOR, P.D.T.O., "Practical Reliability Engineering", John Wiley, 1993.

ME7E5   **CASTING AND WELDING PROCESSES**   **L T P C**
                                                                   3 0 0 3

OBJECTIVE:
• The objective of the course is to impart knowledge on Design of Gating system for castings, Foundry Practice of Ferrous, Non Ferrous alloys, Foundry Mechanisation Welding Processes and Welding Metallurgy.

UNIT I   DESIGN OF GATING SYSTEM   11
Gating System design pouring Time – Choke Area – Sprue – Other gating elements – Risering design - Caines – modulus – Naval research Laboratory method – feeding distances – Chills feeding Aids – design of Castings.

UNIT II   FERROUS AND NON FERROUS CASTINGS   10
Steel Casting – The family of cast iron – melting of steels and cast irons – Grey iron foundry practice – Ductile iron – Malleable Iron casting design – Considerations Aluminium ,Magnesium,Copper,Zinc. ,Duplex Stainless Steel and Titanium alloys foundry practice.

UNIT III   FOUNDRY MECHANISATION   8
Mechanical equipments in foundry – plant site location, layout – Plant Engineering – Maintenance – Services – Practical aspects.

UNIT IV   WELDING PROCESS AND TECHNOLOGY   8
Friction Welding Process – effect of speed and pressure – explosive welding – plasma arc welding – Electon beam welding – High frequency induction welding - Laser beam weding.

UNIT V   WELDING METALLURGY   8
Weld thermal cycles – Heat Affected Zone(HAZ) – Weldability of steels – Cast Iron – Stainless steel,aluminium – Copper and Titanium alloys – Hydrogen embrittlement – Pro and post weld heat Treatments – weld defects – Testing of Welds.

                                                      TOTAL : 45 PERIODS

TEXT BOOK:
1.   P.N.Rao , Manufacturing Technology , Tata McGraw Hill, 2008.

REFERENCES:
1.   Heine , Loper and Rosenthal, Principles of Metal Casting ,Tata McGraw Hill,2001
2.   A.K.Chakrabarti, Casting Technology and Cast Alloys, Prentice –Hall Of India Ltd, 2005
3.   T.V.Rama Rao, Metal casting Principles and Practice, New Age International,2010
4.   R.S Parmar, Welding Engineering and Technology, Khanna Publishers, 2002

DESIGN OF JIGS & FIXTURES   **L T P C**
                                                                          3 0 0 3

UNIT - I   9
PRINCIPLES OF LOCATION AND CLAMPING - Locating and clamping methods and devices. Objectives of Jigs design – principles of Jig. Types of drill and their design – Module design – chip control, drill bushings.

UNIT – II   9
FIXTURES - Objectives of Fixture design – Fixtures and economics, Types of Fixtures, Grinding Fixtures, Milling Fixtures, Shaping Fixtures, Welding Fixtures, and Assembly Fixture. Clamping force calculations, errors in location and clamping, Design and drawing.

UNIT - III   9
SHEET METAL - Power press types – Press specification, material handling, Equipment cutting action in punch and Die operations, die clearance, cutting forces in blanking, Piercing and shearing, punch and die mounting, stripping force, press tonnage.

UNIT - IV   9
Pilot, Stripper, Pressure pad and automatic stop – Strip layout and material calculations. Selection of Die sets – Designing of simple, progressive and compound die sets.

UNIT - V   9
FORMING DIE DESIGN - Bending methods, bend radius, bend allowance, spring back, bending pressure. Design of bending die, metal flow in drawing, single and double action die, development of blank reduction factor, drawing forces, blank diameter calculation, Design of drawing die. Principles of forging and extrusion dies. Defects and remedies.

                                                                   TOTAL : 45 PERIODS

TEXT BOOKS
1.   DONALDSON. C, Tool Design, Tata McGraw Hill Co Ltd.
2.   HOFFMAN. G, Fundamentals of Tool Design, SMF Publishers.

REFERENCES
1.   KEMPSTER, Introduction to tool design and jigs and fixtures.
2.   KORASAKOW, Fundamentals of Jigs and Fixtures, MIR Pub.
3.   JOSHI. P.H. Jigs and Fixtures, Tata McGraw Hill Co Ltd.
4.   Hiram E. Grant, Jigs and Fixtures, TMH, 2006.

DESIGN FOR MANUFACTURING **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the principles of design such that the manufacturing of the product is possible.
- To educate students on various design aspects to be considered for manufacturing the products using different processes.

UNIT I   MANUFACTURING METHODOLOGY AND PROCESESS   9

Methodologies and tools, design axioms, design for assembly and evaluation, minimum part assessment, Taguchi method, robustness assessment, manufacturing process rules, designer's tool kit, Computer Aided group Technology, failure mode effects analysis, Value Analysis, Design for minimum number of parts, development of modular design, minimizing part variations, design of parts to be multi-functional, multi-use, ease of fabrication, Poke Yoke principles.

UNIT II   GEOMETRIC ANALYSIS   9

Surface finish, review of relationship between attainable tolerance grades and different machining processes, part features-feature of size-control from-placement material condition – MMC – LMC

UNIT III   FORM DESIGN OF CASTINGS AND WELDMENTS   9

Redesign of castings based on parting line considerations, minimizing core requirements, redesigning cast members by welded structure , use of welding symbols.

UNIT IV   MECHANICAL ASSEMBLY   9

Selective assembly, deciding the number of groups, control of axial play, examples,Grouped datum systems , different types, geometric analysis and applications, design features to facilitate automated assembly, Assembly analysis worst case Arithmetic method, Monte - Carlo method.

UNIT V   TRUE POSITION THEORY   9

Virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging,examples. Operation sequence for typical shaft type of components. Preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples.

TOTAL : 45 PERIODS

TEXT BOOKS :

1.   Harry pack, "Designing for Manufacture", Pitman Publications, 1983.
2.   Matousek, "Engineering Design, - A Systematic Approach" – Blackie & Son Ltd, London, 1974

REFERENCE BOOKS:

1.   Spotts M.F. "Dimensioning and Tolerance for Quantity Production, Prentice Hall Inc.1983.
2.   Oliver R. Wade, "Tolerance Control in Design and Manufacturing ". Industrial Press Inc.New York Publications. 1967.
3.   James G. Bralla. "Hand Book of Product Design for Manufacturing". McGraw Hill Publications, 1983.
4.   Trucks H.E. "Design for Economic Production". Society of Manufacturing Engineers, Michigan, 2nd edition, 1987.

ME7E8   **TURBOMACHINES**   **L T P C**
                                                                              3 0 0 3

UNIT - I   9
BASIC CONCEPT OF TURBO MACHINES- Definition and classification of turbo machines, specific work, T-S and H-S diagram, equation of energy transfer. Losses – Total-to-total efficiency, total to static efficiency, infinitesimal stage efficiency, effect of reheat, preheat.
Aero-foil section, cascading of compressor and turbine blades, energy transfer in terms of lift and drag coefficient for compressor and turbine blades, variation of lift, deflection and stagnation pressure loss with incidence.

UNIT - II   9
CENTRIFUGAL FANS, BLOWERS - Construction details, induced, backward and radial blades, diffuser, volute casing stage work, stage pressure rise, stage pressure coefficient, stage efficiency, degree of reaction, various slip factors
AXIAL FLOW FANS: stage velocity triangles, blade loading and flow co efficient, static pressure rise H-S diagram, degree of reaction, work done factor, Free and forced vortex, performance

UNIT – III   9
CENTRIFUGAL COMPRESSOR - Construction – Stage velocity triangles h-s diagram – Slip factor – Diffuser – Volute casing – Stage losses – performance characteristics.

UNIT - IV   9
AXIAL TURBINE - Stage velocity triangle, work, single impulse turbine, speed ratio, maximum utilization factor, multistage, velocity compound impulse, multistage pressure, compound impulse, degree of reaction, zero reaction stages, fifty percent reaction stages, hundred percent reaction, negative reaction, free and forced vortex flow.
 Inward flow radial turbine stage, 90 degree IFR turbine H-S diagram, degree of reaction, steam turbine governing

UNIT - V   9
INTRODUCTION TO CFD - One-Dimensional computations by finite difference methods, Finite element methods, finite volume methods, Neumann boundary conditions, Dirichlet boundary conditions, Governing equations, Navier stokes system of equations. Finite differences, discretization, consistency, stability. Fundamentals of fluid flow modeling. Finite difference applications an heat conduction and convection.

                                                          TOTAL : 45 PERIODS

TEXTBOOKS

1   S.M YAHYA, Turbine, Fans and Compressor, TMH.
2   S.M YAHYA, Fundamentals of Compressible flow with Aircraft and Rocket Propulsion, New Age International, 1996
3   GANESAN. V, Gas Turbines, TMH, 1999
4   T. J. CHUNG, Computational Fluid Dynamics, Cambridge University Press, 2003.

REFERENCES

1   ASCHER .H. SHAPORO, The Dynamics and Thermodynamics of Compressible Flow VOL I and VOLII The Ronald Press. Co, NY 1995.
2   JHON D.ANDERSON Jr. Introduction to Flight, III Edition, Mc – Graw Hill ISE 1989.
3   ALAN J. CHAPMAN, WILLIAM.F.WALKER, HOLT, Introduction to gas dynamics, Rineharl and winston, 1971
4   DR.SL. SOMASUNDRAM, Gas dynamics and jet propulsion.
5   A.H.CHURCH ND.JAGDISH LAL, Centrifugal Pumps and Blower, Metropolitan Book Co. PVT Ltd.
6   HILL D. PETERSON C. Mechanics & Thermodynamics of Propulsions, Addison Wiley, 1999
7   SULTON GP. Rocket Propulsion elements, John Wiley, New York, 1986
8   COHEN H. REC ROGERS & SRAVANAMUTOO, Gas Turbine Theory, Addison Wiley, 1987
9   GOPALAKRISHNAN G. & PRITHVIRAJ D, Treatise on Turbo machines, Jupiter Publications, 2000
10   DAVID M. EGGLESTON and FOREST S. STODDARD, Wind Turbine Engineering Design, Van Nostrand, 1987
11   SHEPERD DG. Theory of Turbo machines, McMillan, 1969
12   KADHAMBHI V. MANOHAR PRASAD, Introduction to Energy Conversions, Vol – III, Turbo machines, Wiley Eastern, 1997

ME7E9 **TOTAL PRODUCTIVE MAINTENANCE** **L T P C**
                                                      3 0 0 3

OBJECTIVE:

• To teach the students basic concepts of Total Productive Maintenance. Expose the students to the objectives, maintenance models, group activities, logistics, condition monitoring and implementation of Total Productive Maintenance.

UNIT I   MAINTENANCE CONCEPTS   9
Introduction - Objectives and functions – Productivity, Quality, Reliability and Maintainability
(PQRM) - Terotechnology – Reliability Centered Maintenance - Predictive Maintenance
- Condition Based Maintenance – maintainability prediction – availability and system effectiveness- maintenance costs – maintenance organization.

UNIT II   MAINTENANCE MODELS   9
Minimal repair – As Good As New policy – maintenance types – balancing PM and breakdown maintenance- PM schedules: deviations on both sides of target values – PM schedules: functional characteristics – replacement models.

UNIT III   TOTAL PRODUCTIVE MAINTENANCE   9
Zero breakdowns – Zero Defects and TPM – maximizing equipment effectiveness – Autonomous maintenance program – five pillars of TPM – TPM small group activities – TPM organization – Management Decision – Educational campaign – Creation of Organizations – Establishment of basic policies and goals – Formation of master plan - TPM implementation.

UNIT IV   MAINTENANCE LOGISTICS   9
Human factors in maintenance – maintenance manuals – maintenance staffing methods – queuing applications – simulation – spare parts management – maintenance planning and scheduling.

UNIT V   ONLINE MONITORING   9
Condition monitoring - Infrared Thermography, Oil Analysis, acoustic emissions testing, Motor Current Analysis, Vibration Measurement and Analysis, Wear Debris Monitoring, Visual checks - corrosion control - Maintenance Management Information System - Expert system applications.

                                                      TOTAL: 45 PERIODS

TEXT BOOKS :
 1.   Nakajima S., "Introduction to TPM", Productivity Press, Chennai, 1992.
 2.   Srivastava S.K., "Maintenance Engineering (Pri.Practices & Management)", S. Chand Group, 2011.

REFERENCES :
1.   Wireman T., "Total Productive Maintenance", Industrial Press Inc., New york, 2004
2.   Goto F., "Equipment planning for TPM Maintenance Prevention Design", Productivity Press, 1992.
3.   Shirose K., "Total Productive Maintenance for Workshop Leaders", Productivity Press, 1992.
4.   Shirose K., "TPM for Operators", Productivity Press, 1996.
5.   Suzuki T., "New Directions for TPM", Productivity Press, 1993.
6.   Kelly A., "Maintenance planning and control", Butterworths, London, 1991.

UNIT -I

INTRODUCTION TO DIGITAL MANUFACTURING: Definition of digital manufacturing, Operation Mode and Architecture of Digital Manufacturing System.(3)

INTRODUCTION TO BIG DATA : Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases-(6)

UNIT II

REVERSE ENGINEERING AND CAD MODELING: Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT-III

COMPUTER AIDED MANUFACTURING: Component modeling, Machine and tool selection, Defining process and parameters, Tool path generation, Simulation, Post processing. (6)

UNIT-IV

DIGITAL FACTORY AND VIRTUAL MANUFACTURING: Introduction, Scope, Methods and Tools Used in Virtual Manufacturing, Benefits. Virtual factory simulation. (5)

INTERNET OF THINGS: Introduction, Applications, IoT data management requirements, Architecture of IoT, Technological challenges, RFID and the Electronic Product Code (EPC) network, The web of things, Issues in implementing IoT. (6)

UNIT-V

 ADDITIVE MANUFACTURING: Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-BenefitsApplications. LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS: Stereolithography Apparatus (SLA): Solid Ground Curing (SGC): Fused deposition Modeling (FDM): Laminated Object Manufacturing (LOM):

<div align="center">REFERENCES:</div>

1. Ibrahim Zeid and Sivasubramanian R, "CAD/CAM - Theory and Practice", Tata McGraw Hill Education, 2011.

2. Vinesh Raja and Kiran J Fernandes, "Reverse Engineering- An Industrial Perspective", Springer-Verlag, 2008

3. Pham D T and Dimov S S, "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping", Springer-Verlag, 2001.

4. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", Springer, 2005.

5. Adrian McEwan and Hakim Cassimally, "Designing the internet of things", Wiley, 2013.

6. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.

7. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.

ME8E1 **DESIGN OF HEAT TRANSFER EQUIPMENTS** **L T P C**
3 0 0 3

UNIT - I 9

Thermal and hydraulic design – inner pipes – annulus, Hair pin heat exchangers – base inner tube – finned inner multitubes – parallel and series arrangements, pressure drop, constructional features.

Heat pipes – structures – applications – basic relations – performance characteristics – effects of working fluid and operating temperature, wick – selection of material – pore size.

UNIT - II 9

Basic components – shell – tube bundles – baffles – types and geometry. Design procedure – preliminary estimation of size, pressure drop and heat transfer calculations – shell and tube sides – Kenn method – Bell – Delaware method.

UNIT- III 9

Compact heat exchangers – types – constructional features, heat transfer and pressure drop calculation – finned plate and tube.

Gasketted – plate heat exchangers – constructional features – plate pack and frame – operational characteristics – flow arrangement, heat transfer and pressure drop calculation, performance analysis, comparison with other types of heat exchangers.

UNIT - IV 9

Shell and tube condensers – horizontal & vertical types – design and operational consideration, plate condensers, air cooled and direct contact types, condenser for refrigeration, evaporative condensers.

Evaporation for refrigeration & air conditioning – chillers, air coolers – thermal analysis – Shah Kandhkar and Ghngor and Wintertom correlations, standard types.

UNIT - V 9

Cooling towers – types – basic relation – heat balance and heat transfer – characteristics, effects of – packings – geometry, spray design, selection of – pumps, fans. Testing, maintenance, environmental effects, wind loads, typical installations.

TOTAL : 45 PERIODS

TEXTBOOK
    1   ARTHUR P. FRAAS, Heat Exchanger Design, John Wiley & Sons, 1997.

REFERENCE BOOKS
    1   SADIK KAKAC & HONGTAN LIN, Heat Exchangers, CRC Press, London, 1998.
    2   KENN D, Process Heat transfer, Tata McGraw Hill, 1997.
    3   WALKER, Industrial Heat Exchangers, McGraw Hill, 1980.
    4   HOLGER MARTIN, Heat Exchangers, Hemisphere Publishing Corporation, London, 1982.

ME8E2   **CRYOGENIC ENGINEERING**   **L T P C**

                                                                          3 0 0 3

UNIT - I   **9**

 INTRODUCTION - Cryogenic Engineering – properties of cryogenic fluids – oxygen, Nitrogen, Argon, Neon, Fluorine, Helium, Hydrogen. Properties of solids – mechanical, thermal and electrical – superconductivity.

UNIT - II   **9**

CRYOGENIC REFRIGERATION - Principle – Joule Thompson expansion, cascade processes, Ortho Para Hydrogen conversion, cold gas refrigerators, Linda Hampson cycles, Claude & Cascaded system, magnetic cooling, sterling cycle cryocoders.

UNIT - III   **9**

CRYOGENIC REQUIREMENTS - Cryogenic – heat exchangers, compressors, expanders, effect of various parameters in performance and system optimization. Insulation and storage equipment's for cryogenic fluids, industrial storage and transfer of cryogenic fluids.

UNIT – IV   **9**

GAS SEPARATION & PURIFICATION **-**Ideal gas, mixture characteristic – composite diagrams. Gas separation – principles of rectification, flash calculation, rectification column analysis – air separation, gas purification.

UNIT - V   **9**

CRYOGENIC INSTRUMENTATION - Properties and characteristic of instrumentation, strain, displacement, pressure, flow, liquid level, density and temperature measurements in cryogenic range.

                                                                TOTAL : 45 PERIODS

TEXT BOOKS
1.   SCOTT, Cryogenic Engineering, Van Nostrand Co.. 1985

REFERENCES
1.   RANDAL F. BARRON, Cryogenic Systems, McGrawHill, 1985.
2.   FLYNN T.M. Cryogenic Engineering Maxwell Dekker, 1997.

ME8E3 **INTERNAL COMBUSTION ENGINES** **L T P C**
3 0 0 3

UNIT - I 9

Spark ignition engine – mixture requirements – feed back control carburetors – petrol injection systems – normal and abnormal combustion – factors affecting knock – shape of combustion chambers in SI engines.

UNIT - II 9

Normal and abnormal combustion in CI engines, direct and indirect ignition systems, combustion chambers – air movements in CI engines – fuel spray structure, spray generation and evaporation –turbo charging in IC engines.

UNIT - III 9

 Alternate fuels – alcohol – hydrogen – natural gas – liquefied petroleum gas – suitability, engine modifications, merits and demerits as IC engine fuels.

UNIT - IV 9

Pollutants from IC engines – formation of NOX, CO and hydrocarbon, emission mechanism, particulate emission – method of controlling emissions – catalytic convectors and particulate traps – methods of measurements of emission and driving cycles.

UNIT - V 9

 Stratified charge spark ignition engine – lean burn engines, dual fuel engine – multi point fuel injection gasoline engines – homogeneous charge compression ignition engines – plasma ignition, electric /hybrid vehicles.

TOTAL : 45 PERIODS

TEXT BOOKS
1. GANESAN V. Internal Combustion Engines, TMH, 2008, 3rd Edition.
2. GILL SMITH & ZURICH, Fundamentals of IC Engines.
3. MATHUR R.B AND SHARAM. R.B, Internal Combustion Engines, Dhanpat Rai & Sons, 1994.

REFERENCE BOOKS
1. DOMKUNDWAR V.M, Internal Combustion Engines, Dhanpat Rai & Sons, 1999
2. JOHN B. HEYWOOD, Internal Combustion Engine Fundamentals, McGraw Hill, 1988
3. P. L. Ballaney, Internal Combustion Engines, Khanna Publishers, 2006, 6th Edition

ME8E4   **PRODUCT DESIGN AND DEVELOPMENT**   **L T P C**
                                                 3 0 0 3

OBJECTIVE:
* To Teach the students basic concepts of Product Design and Process Development. Expose the students to the importance, various stages, concepts, management and prototyping of Product Design and Process Development.

UNIT I   INTRODUCTION   9
Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement.

UNIT II   CONCEPT GENERATION, SELECTION AND TESTING   9
Plan and establish product specifications. Task - Structured approaches - clarification - search- externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance – manufacturability.

UNIT III   PRODUCT ARCHITECTURE   9
Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV   INDUSTRIAL DESIGN   9
Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs – conceptualization - refinement - management of the industrial design process.

UNIT V   DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT   9
Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Ulrich K.T. and Eppinger S.D., "Product Design and Development" McGraw – Hill International Editions,1999.

REFERENCES:
1 Belz A., 36-Hour Course: "Product Development" McGraw-Hill, 2010.
2 Rosenthal S., "Effective Product Design and Development", Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.
3 Pugh S., "Total Design – Integrated Methods for successful Product Engineering", Addison Wesley Publishing, 1991, ISBN 0-202-41639-5.

ROBOTIC TECHNOLOGY   **L T P C**
                                                                                3 0 0 3

UNIT – I   **9**
INTRODUCTION - History of robotics – Configuration of manipulator – Arm and wrist - Work volume and spatial resolution – Linkage and joints of manipulators, drive systems, feedback devices, Concepts of degrees of freedom, types of end effectors – Basic sensors in robotics including machine vision

UNIT - II   **9**
COORDINATE FRAMES AND TRANSFORMATION - Coordinate frames – Description of objects in space – Various types of transformations of vectors – Basic transformation matrices – Forward and inverse kinematic equations – Danavit and Hartenberg representation – Inverse kinematic solution

UNIT - III   **9**
DIFFERENTIAL MOTION OF MANIPULATORS - Differential relationships, Jacobian of manipulator – Inverse Jacobian, Static analysis

UNIT- IV   **9**
DYNAMIC FORCES AND TRAJECTORY PLANNING - Lagrangian mechanics, Dynamic equations for multi degree of freedom manipulators – Inverse dynamics – Joint space planning – Cartesian space planning – Linear feedback control, Decoupling control – Force control strategies

UNIT - V   **9**
ROBOT PROGRAMMING AND APPLICATIONS - Methods of robots programming – lead and teach method - Explicit languages, task level languages – Introduction – Workcell design and control, Robot cycle time analysis   Industrial Applications – machining – welding – assembly – material handling – loading and unloading – hostile and remote environments – Economics of robots.

                                                                    TOTAL : 45 PERIODS

TEXTBOOKS
1.   MIKELL P. GROOVER, Industrial Robotics, MGH, 1996.
2.   MOHSEN SHAHINPOOR, A Robot Engineering Text Book, Harper & Row,

REFERENCE BOOKS
1.   JOHN J. CRAIG, Introduction to Robotics, Addison Wesley, ISE, 1999
2.   ARTHUR CRICHLOW, Introduction to Robotics, Macmillan, 1985.
3.   YORAM KOREN, Robotics for Engineers, MGH, 1985.
4.   FRANCIS N. NAGY, Engineering Foundation of Robotics, Addison Wesley,

ME8E6 **TRIBOLOGY** **L T P C**
3 0 0 3

UNIT - I   **9**
DRY FRICTION - Dry friction – topography of surfaces – contact between surfaces – sliding friction – energy dissipation. Theory of molecular attraction – fretting corrosion and prevention – variables in dry friction – present concept of friction – boundary friction – oiliness – variables of boundary friction – friction characteristics of metals and non-metals– rolling friction – sources of measurement of friction.

UNIT - II   **9**
Wear – types – mechanism – factors affecting wear. Adhesive wear – abrasive wear, fatigue wear – corrosive wear – brittle fracture wear. Delamination – wear measurement.

UNIT - III   **9**
Fundamentals of viscosity and flow – Petroff's equation – friction torque – viscosity measurement – factors affecting viscosity. Principle of hydrostatic lubrication – hydrostatic step bearing – multi recess bearing – design problems – different types of compensation and their effect on bearing, parameters – hydrostatic lift, simple problems – hydrostatic journal bearing, simple problems – hydrostatic squeeze films.

UNIT - IV   **9**
HYDRODYNAMIC LUBRICATION - Solution of Reynolds equation – application to tilting pad thrust bearing – design of hydrodynamic journal bearings – force feed of oil flow with various types of grooves – dynamic bearings and rotor systems – brief discussion, lubrication systems, bearing materials – gas bearings – brief discussion – elastohydrodynamic lubrication – brief discussion.

UNIT - V   **9**
LUBRICANTS AND MAINTENANCE - Lubricants – types-solids ,and liquid-properties-additives-testing-reclamation of lubricants, surface treatment-phospating of metal surface, Teflon coating. Predictive maintenance-signature analysis and condition monitoring-basic principles-instrumentation.

TOTAL : 45 PERIODS

TEXT BOOKS
1 HUTCHINGS. M, Tribology, Friction and Wear of Engg. Materials, Edward Arnold, London, 1992.
2 MAJUMDAR, Introduction of Tribology of Bearings, A.H.Wheeler & Co., 1986.

REFERENCES
1 NCALC, NEWNCS, Tribology Handbook, Butterworths, 1975.
2 DUDLEY D.FULLER, Theory and Practice of Lubrication for Engineers, John Wiley & Sons, 1984.
3 CAMERON.A, Basic Lubrication Theory, Wiley Eastern Ltd., 1987.
4 BHARAT BHUSAN & B.K.GUPTA, Handbook of Tribology, McGraw Hill Inc., 1991.

(APPROVED HAND BOOK MAY BE USED IN THE EXAMINATION)

ME8E7   **NON-TRADITIONAL MACHINING PROCESSES**   **L T P C**
3 0 0 3

OBJECTIVES:
*   To understand material removal by using various forms of energy and machining new materials and complex parts with high accuracy by using non-traditional machining.

UNIT I   INTRODUCTION   7

Need of Non-Traditional Machining Processes – Classification Based on Energy, Mechanism, source of energy, transfer media and process - Process selection-Based on Physical Parameters, shapes to be machined, process capability and economics – Overview of all processes.

UNIT II   MECHANICAL PROCESS   10

Ultrasonic Machining: Principle- Transducer types – Concentrators - Abrasive Slurry - Process Parameters – Tool Feed Mechanism – Advantages and Limitations – Applications. Abrasive Jet Machining: Process- Principle – Process Variables – Material Removal Rate - Advantages and Limitations – Applications. Water Jet Machining: Principle – Process Variables - Advantages and Limitations – Practical Applications – Abrasive water jet machining process.

UNIT III   ELECTRICAL DISCHARGE MACHINING   10

Electrical Discharge Machining: Mechanism of metal removal – Dielectric Fluid – Flushing methods - Electrode Materials - Spark Erosion Generators – Electrode Feed System – Material Removal Rate – Process Parameters – Tool Electrode Design – Tool wear Characteristics of Spark Eroded Surfaces- Advantages and Limitations – Practical Applications. Electrical Discharge Wire Cut and Grinding: Principle – Wire Feed System - Advantages and Limitations
–Practical Applications

UNIT IV   CHEMICAL AND ELECTRO CHEMICAL MACHINING   10

Chemical Machining: fundamentals, Principle –classification and selection of Etchant - chemical milling, Engraving, Blanking - Advantages and limitations – Applications. Electro Chemical Machining: Electro-chemistry of the process-Electrolytes - Electrolyte and their Properties – Material Removal Rate – Tool Material – Tool Feed System – Design For Electrolyte Flow – Process Variables - Advantages and Limitations – Applications - Electro Chemical Grinding: Honing, cutting off, Deburring and turning.

UNIT V   HIGH ENERGY MACHINING PROCESS   8

Electron Beam Machining: Principle –Generation and control of electron beam-Advantages and Limitations – Applications. Laser Beam Machining: Principle –Solid and Gas Laser Application – Thermal Features of LBM - Advantages and Limitations – Applications. Ion Beam Machining: Equipment – process characteristics - Advantages and Limitations – Applications. Plasma Arc Machining: Principle –Gas mixture– Types of Torches – Process Parameters - Advantages and Limitations – Applications. Ion Beam Machining – Principle – MRR – advantages, limitation, applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. P.C Pandey And H.S. Shan, "Modern Machining Process", Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 2007

2. V.K. Jain, " Advanced Machining Process", Allied Publishers Pvt Limited 2007

REFERENCES:

1. Amithaba Bhattacharyya , "New Technology", The Institution Of Engineers , (India) "Production Technology", HMT Bangalore, Tata Mc Graw–Hill Publishing Company Limited, New Delhi, 2006.

2. Hassan El – Hofy "Advanced machining Processes" MC Graw-Hill, 2005.

THEORY OF METAL FORMING   **L T P C**
                                                                     3 0 0 3

OBJECTIVES:

•   This course aims to impart the knowledge about various metal forming processes. It deals with metal forming concepts like theory of plasticity and special metal forming techniques. After this course a student will have a good exposure about this subject. This also gives the recent trends in the metal forming processes.

UNIT- I THEORY OF PLASTICITY   **9**

Theory of plastic deformation – Engineering stress and strain relationship – Strain rate – Stress tensor – Strain tensor – Yield criteria – Plastic stress strain relationship – Plastic work – Plastic anisotropy.

UNIT - II   CONSTITUTIVE RELATIONSHIPS AND INSTABILITY   **7**

Uniaxial tension test – Mechanical properties – Work hardening, Compression test, bulge test, plane strain compression, plastic instability in uniaxial tension stress, plastic instability in biaxial tension stress – Material models – Elasto plasticity, Rigid plasticity, visco plasticity.

UNIT - III   ANALYSIS OF METAL FORMING   **12**

Slab analysis – Slip line method, upper bound solutions, numerical methods, contact problems, effect of friction, thermo elastic- analysis of forging, rolling, extrusion and wire drawing processes – forming load – Net and Near net shape forming – Cold and Hot Forging.

UNIT- IV   SHEET METAL FORMING   **8**

Sheet Metal Forming methods – Bending – Drawing – Deep Drawing – Stretch Forming – Formability and workability – Forming limit diagram – Analysis of Sheet Metal Forming – HERF Techniques – Principles and Process Parameters – Superplastic Forming.

UNIT - V   SPECIAL METAL FORMING PROCESSES   **9**

Orbital forging, Isothermal forging, Warm forging, Hot and Cold isotrophical pressing, high speed extrusion, rubber pad forming, micro blanking – Overview of Powder Metal Techniques – Powder rolling.

                                                      TOTAL : 45 PERIODS

TEXT BOOKS:

1. Dieter G.E, "Mechanical Metallurgy" Mc Graw – Hill Co. S1. Edition 1995
2. Surender Kumar, "Technology of Metal Forming Processes", PHI, New Delhi, 2008.

REFERENCES:

1 Nagpal G.R "Metal Forming Process", Kanna Pub, New Delhi – 2000.
2 Wagoner, R.H and Chenot, JJ Metal Forming Analysis, Cambridge University Press,2002.
3 Slater, R.A.C., Engineering Plasticity – Theory and Applications to Metal Forming, John Wiely and Sons, 1987.
4 Shiro Kobayshi, Altan. T, Metal Forming and Finite Element Method, Oxford University Press, 1989.
5 Hosford, W.F and Caddell, R.M., Metal Forming Mechanics and Metallurgy, Prentice Hall Eaglewood Cliffs, 1993.6Narayanaswamy. R, Theory of Metal Forming and Plasticity Narosa Publishers, 1999.

7 Kurt Lange, "Handbook of Metal Forming", Society of Manufacturing Engineers, Michigan, USA, 1988.
8 Avitzur, "Metal Forming – Process and Analysis", Tata McGraw-Hill Co., New Delhi,

     PRODUCTION OF AUTOMOTIVE COMPONENTS   **L T P C**
                                                                                3 0 0 3

OBJECTIVE:

•   To study the manufacturing methods of automotive components and its developments

UNIT I   **INTRODUCTION TO AUTOMOTIVE COMPONENTS**   **9**
Elements of automotive components manufacturing- Cylinder blocks, materials and production-Liners, Cylinders heads, materials and Production methods-Production of oil pan- Engine Mountings.

UNIT II   **ENGINE PARTS**   **9**
Piston-types- materials-manufacturing methods-Piston rings-production-testing methods
-Piston pin-types-materials-manufacturing methods-Production of connecting rod and crankshaft.

UNIT III   **VALVES TRAIN AND FUEL SYSTEM**   **9**
Valves-Materials-Production methods, Production valve train assembly- Cam shafts-manufacturing methods. Fuel system for petrol and diesel engines-principles of carburetors-fuel pumps-fuel injection pumps.

UNIT IV   **TRANSMISSION SYSTEM AND OTHER ACCESSORIES**   **9**
Transmission system-gear box-types-clutch system, Brakes ,suspension- - cooling and lubrication system, ignition system -turbochargers, superchargers.

UNIT V   **MODERN MANUFACTURING METHODS**   **9**
Need of modern trend – Application of CAD, CAM, and Robotics- Latest technology and innovation- Electric , hybrid, fuel cell powered vehicle.

                                                  TOTAL: 45 PERIODS

TEXT BOOK:
1   Yamagata H., "The science and technology of materials in automotive engines", Wood Head publishing Limited, 2005

REFERENCE BOOKS:

1   Nunney M.J., "Light and Heavy Vehicle Technology", Elsevier Ltd.,2007,Fourth Edition.
2   Garrett T.K., Newton K. and Steeds W., "The Motor Vehicle" , Butterworth-Heinemann",2001,Thirteenth Edition.

ME8EA	VIBRATION AND NOISE CONTROL	L T P C
		3 0 0 3

UNIT I   9

SINGLE AND TWO DEGREES OF FREEDOM VIBRATION - Review of single degree of freedom systems – free damped vibration – linear and torsion vibrations, seismometer, accelerometer. Two degrees of freedom – vibration absorbers – undamped and damped, vibration isolation.

UNIT II   9

MULTI DEGREE FREEDOM VIBRATIONS - Multi degree vibration system – free vibration – close coupled and far coupled systems, eigen value problems, Orthogonality of mode shapes, model analysis, forced vibration modal analysis, numerical methods – dunkerley, Raleigh and Holzer methods.

UNIT III   9

BALANCING **-** Rotor balancing methods – rigid &flexible rotor balancing, modal balancing – analytical developments – application to balancing, advantage and limitations of modal balancing, influence coefficient balancing, analytical developments balancing –procedure – advantages and limitations. Unified balancing approach – analytical development- balancing procedure – experimental comparison of various methods.

UNIT IV   9

VIBRATION MONITORING - Experimental methods in vibration analysis – vibration exciters measurements devices, analyzer, condition based maintenance of monitoring and analysis – case studies.

UNIT V   9

NOISE CONTROL **-** Sound wave characteristic – levels and decibels – directivity, source of noise, estimation of noise source, acoustics of walls – enclosures barriers, sound absorbing materials duct noise, mufflers.

TOTAL : 45 PERIODS

TEXT BOOKS

1   RAO J.S AND GUPTA K, Theory and Practice of Mechanical, John Wiley
2   TIMSOHENKO, S. YOUNG D.H & WEAVER W, Vibration Problems in Engineering 4th ed. John Wiley & Sons, 1967.
3   KEWAL K. RUJARA, Vibrations and Noise for Engineering, Dhanpat Rai & Sons.

REFERENCE BOOKS

1.   ASHOK KUMAR MALLIK, Principle of Vibration Control, Affiliated East West Press, 1993
2.   GROVER. G.K, Mechanical Vibration, New Chand Bros., Roorkie (UP), 1989.
3.   MARK S, DARLOW, Balancing of High Speed Machinery, Springer Verlog

ME8EB   **REFRIGERATION AND AIR CONDITIONING**   **L T P C**

                                                                             3 0 0 3

UNIT I   9

Review of thermodynamics, principle of refrigeration, refrigeration cycle: air cycle system, Bell – Coleman cycle system. VAPOUR COMPRESSION REFRIGERATION: Analysis of Vapour compression refrigeration, uses of P.H charts, performance test, Vapour absorption refrigeration, absorption cycle, Claude system, cascade system, comparison of performance & COP.

UNIT II   9

Compressor – reciprocating, rotary (elementary treatment). Condenser – evaporator –cooling tower. Refrigerant- properties – selection of refrigerants, refrigeration plant operation and controls - testing and charging of refrigeration units.
APPLICATION: Ice plant, food storage plants, milk chilling plant, refrigeration cargo ships, cryogenic in medicine & biological uses.

UNIT III   9

Review of fundamental properties of psychrometry use of psychometric charts, psychometric processes, grand and room sensible heat factor, by pass factor, requirements of comfort air conditioning, comfort and comfort chart, factor governing optimum effective temperature recommended design conditions, ventilation standards.

UNIT IV   9

Cooling load calculations, types of load design, space cooling load, heat transmission through building, solar cooling & heating, solar radiation, infiltration heat source (sensible & latent) Outside air & fresh air load, estimation of total load, design of air conditioning system.

UNIT V   9

AIR CONDITONING SYSTEMS: Commercial & industry stores and public building A/C, ventilation, air conditioning equipment, air cleaning and air filters, humidifiers, dehumidifiers- air washer, condenser, cooling tower and spray pounds, elementary treatment of duct design, air distribution system.

TOTAL : 45 PERIODS

TEXTBOOKS
1.   ARORA C.P, Refrigeration and Air Conditioning, TMH, New Delhi, 1988.
2.   P.L BALLANY, Refrigeration and Air conditioning

REFERENCES
1.   ARORA S.C AND DOMKUNDWAR S, Refrigeration & Air Conditioning, Dhanpat Rai and Sons Publishers, 1990
2.   MANOHAR   PRASAD, Refrigeration and Air Conditioning, Wiley Eastern ltd, 1983
3.   ROY J. DOSSAT, Principles of Refrigeration, SI version, Wiley Eastern Ltd, 1985
4.   STOEKER, Refrigeration & Air Conditioning, McGraw Hill

ME8EC   **COMPUTATIONAL FLUID DYNAMICS**   **L T P C**
                                                                     3 0 0 3

UNIT I   **9**

Introduction to CFD Form of mass, energy and momentum equations, description of terms; boundary conditions and simple solution examples.

UNIT II   **9**

Static Features of CFD code: FLUENT Modeling for steady incompressible flow, pressure drop and heat transfer.

UNIT III   **9**

Solution Methods Solution algorithms, discretisation schemes, solution convergence, divergence and residuals.

UNIT IV   **9**

 Model Formulation Geometry and grid design, boundary conditions of the domain, choice of physical models for turbulence and heat transfer, modeling of fluid properties.

UNIT V   **9**

Case Study Examples modeling pressure drop and heat transfer in a range of engineering examples.

                                               TOTAL : 45 PERIODS

TEXTBOOKS
1. FLETCHER, C.A.J, Computational Techniques for Fluid Mechanics, Springer-Verlag, 1991
2. SHAW, C.T, Using Computational Fluid Dynamics, Prentice Hall, 1992

REFERENCES
1. J.D.ANDERSON, Computational Fluid Dynamics.
2. NK BOSE, Computer Numerical Methods for Fluid Mechanics.

INTRODUCTION TO NANO TECHNOLOGY **L T P C**

3 0 0 3

UNIT I 9
INTRODUCTION TO PHYSICS OF SOLID STATE - Intermolecular forces: thermodynamic aspects - Quantum Mechanical Treatment of the Many-Particle Problem - Potential Energy Surface - Pair Potential Approximation - Advantages and Limitations of the Pair Potential Approximation -Phenomenological Potentials - Pseudo-Potentials - Many-Body Potentials.

UNIT II 9
FUNDAMENTALS OF NANOSCIENCE - Size dependence of properties - Particle size determination - Bulk to nano transition - Semiconducting nanoparticles - Carbon nanostructures - Mechanical properties (hardness, ductility, elasticity) - Optical properties of nanotubes - Electrical properties of nanotubes.

UNIT III 9
PREPARATION OF NANOSYSTEMS - Introduction to nanolithography - Carbon nanotubes: preparation - Synthesis and preparation of nanomaterials (crystalline and thinfilm) - Physical and chemical methods - Control and stability (size, shape, composition).

UNIT IV 9
CHARACTERIZATION OF NANOSYSTEMS - Thermal Stability - Basic Material Properties - Mean Mean Values and Correlation Functions - X-ray diffraction - Scanning Electron Microscopy - Scanning Tunneling Microscopy - Electron Microscopy - X-ray absorption spectroscopy – Photoelectron emission spectroscopy.

UNIT V 9
NANO-ENGINEERING: APPLICATIONS - Nanotubes, nanowires, and nanodevices-introduction - Functional Nanostructures – Introduction to molecular electronics - Field emission and Shielding - Applications in Computers - Applications in fuel cells - Applications in chemical sensors - Applications in mechanical reinforcement - Microelectromechanical systems (MEMs) - Nanoelectromechanical systems
(NEMs) - Molecular and Supramolecular Switches.

TOTAL : 45 PERIODS

TEXT BOOKS
UNIT I AND II
1 Charles P. Poole and Frank J Owens. *Introduction to nanotechnology.*
2 Wiley Interscience, 2003.
3 Crandall, B. C. and Lewis, James (Eds.) *"Nanotechnology: Research and Perspectives"* MIT Press, 1992.
UNIT III AND IV
1 P E J Flewitt, R K Wild. *Physical Methods for Materials Characterization. 2nd Edition*, Institute of Physics Publishing, UK. 2004.
2 Gottstein, Günter. (2004) *Physical Foundations of Material Science.* Springer Verlag.
3 UNIT V
4 Cleland, Andrew N. (2003). *Foundations of Nanomechanics: From Solid-State Theory to Device Applications.* Springer Verlag.
REFERENCES
1 J M Vail, Winnipeg. *Topics in the Theory of Solid Materials.* Institute of Physics Publishing, UK. 2004.
2 M W Barsoum. *Fundamentals of Ceramics.* Institute of Physics Publishing, UK. 2004.
3 A S Edelstein, R C Cammarata, *Nanomaterials: Synthesis, Properties and Applications.* IOP Publishing, UK, 1998.
4 Bhushan, Bharat (Ed.) (2004) *Springer Handbook of Nanotechnology*

ME8EE　　　　　　　**WORK STUDY AND COST ESTIMATION**　　　　**L T P C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3 0 0 3

UNIT I　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
WORK STUDY AND PRODUCTIVITY - Need, Aim and Scope of Work Study, Techniques of Work Study and their relationship, Basic Procedure of Work Study, Productivity and the Standard of Living, Productivity in the individual enterprise, Management techniques to reduce work content and ineffective time, Human Factors in the application of Work Study. Job Evaluation, Merit Rating and Wage Incentive Plans.

UNIT II　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
METHOD STUDY - Introduction, Basic Procedure, Factors involved in Selection of Jobs, Recording Techniques – Charts and Diagrams, Questioning Techniques, Developing improved method.
Principles of Motion Economy, Therbligs, Two Handed process chart, Micromotion and Macromotion Study, SIMO Chart, Design of Work Place Layout, types of Plant Layout, Flow Diagram, String Diagram, Use of Templates and Scale Models, Multiple Activity Chart, Travel Chart.

UNIT III　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
WORK MEASUREMENT -General remarks on Work Measurement, Time Study equipment, Selecting the Job to be studied and making a Time Study, Rating Factors Involved, Allowances to Standard Time, setting Time Standards for Work.
Other Techniques of Work Measurement – Production Study, Activity Sampling, Synthesis – Synthetized Time Standards, Analytical Estimating, Predetermined Motion Time Systems, MTM, Work Factor, Standard Data and its uses.

UNIT IV　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
HUMAN FACTORS IN WORK DESIGN - Ergonomics, work Physiology, human performance, anthropometry, Design of Work Station, Design of Displays and Control.Fatigue and its effects.
Organization of Work Study Department – Place of Work Study Department in the Organization, Structure of Work Study Department, Selection and Training of Work Study Personnel.

UNIT V　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**
COST ESTIMATION - Introduction, Definition, Purpose of Cost Estimation, Cost Estimation Vs Cost Accounting, Components of Cost, Direct Cost, Indirect Cost, Overhead Expenses, Estimation of cost elements, set up, operation, tool change and inspection costs, performance factors, Overheads, different methods of apportioning overheads, Data required for Cost Estimating, Steps in making a cost estimate, Simple Problems - Estimation of production cost of simple components.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　TOTAL : 45 PERIODS

TEXT BOOKS

1.	I.L.O – Introduction to work study, 3rd ed. Universal Publishing Corporation, Bombay.
2.	GUPTA AND PATEL, Work Study, Khanna Publishers.

REFERENCE BOOKS

1.	Mundel, "Motion and Time Study", Prentice Hall of India, New Delhi, 1995.
2.	Ralph M. Barnes, "Motion and Time Study", John Wiley and sons, 1990.
3.	Niebel Benjamin. W., "Motion and Time Study", Richard D. Irwin Inc., 1982.
4.	Dalela. S, "Work Study and Ergonomics", Standard Publishers Distributors, New Delhi, 1999.
5.	Singh .C.K., "Mechanical Costing, Estimation and Project Planning", Standard Publishers Distributors, New Delhi, 1996.
6.	G.B.S.Narangh, V.Kumar, " Production and Costing" Khanna Publishers, New Delhi, 1980.
7.	Banga, Sharma, "Mechanical Estimating and Costing" Khanna Publishers, New Delhi, 1976.
8.	Bridger, R.S., " Introduction to Ergonomics", McGraw Hill, 1995.

ME8EF **ENTREPRENEURSHIP DEVELOPMENT** **L T P C**
                                                     3 0 0 3

OBJECTIVE:

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I   ENTREPRENEURSHIP   9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur
– Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II   MOTIVATION   9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III   BUSINESS   9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment
– Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information –Classification of Needs and Agencies.

UNIT IV   FINANCING AND ACCOUNTING   9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/ CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V   SUPPORT TO ENTREPRENEURS   9

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S.S.Khanka "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.

2. Kuratko & Hodgetts, "Enterprenuership – Theory, process and practices", Thomson

OBJECTIVE:

- To make students to understand various Non Destructive testing methods including advanced techniques, with emphasis on basic principles, limitations and application areas.

UNIT I   INTRODUCTION   9

Visual methods: Optical aids, In-situ metallography, Optical holographic methods, Dynamic inspection.

UNIT II   LIQUID PENETRANT & MAGNETIC INSPECTION   9

Penetrant systems: Principles-Process- Liquid penetrant materials-Emulsifiers-cleaners developers-sensitivity-Advantages, Limitations   and Applications .Magnetic   methods: Advantages, Limitations-Methods of generating fields: magnetic particles and suspending liquids Magnetography-field sensitive probes: applications. Measurement of metal properties.

UNIT III   RADIOGRAPHIC METHODS   9

Principles of radiography- sources of radiation- Ionising radiation -sources-X-rays, gama rays- Recording of radiation-Radiographic sensitivity-Fluoroscopic methods-special techniques- Radiation safety. Advantages ,Limitations and applications.

UNIT IV   ULTRASONIC TESTING OF MATERIALS   9

Advantages, disadvantages, Applications, Generation of. Ultrasonic waves, general characteristics of ultrasonic waves: methods and instruments for ultrasonic materials testing: special techniques.

UNIT V   ELECTRICAL AND OTHER METHODS   9

Electrical methods:Eddy current methods: potential-drop methods, applications-Other methods: Acoustic Emission methods, Acoustic methods: Leak detection: Thermal inspection.

                                                  TOTAL: 45 PERIODS

TEXT BOOKS:
1. Halmshaw R., "Non Destructive Testing", Edward Arnold Publication, London, 1987.
2. Hull B. and John V., "Non-destructive testing", English Language Book Soc., 1989.
3. Ravi Prakash, "Non destructive Testing Techniques", New Age Science, 2009.

REFERENCES:
1. Metals Handbook, "Nondestructive Inspection and Quality Control", Vol. 17, 9th Edition, ASM International
2. Hellier C., "Handbook of Non destructive Evaluation", McGraw-Hill Professional, I edition, 2001.
3. "Non destructive Testing Handbook", Vol. 1-10, 3rd Edition, American Society for Non Destructive Testing, 2010.

ME8EH **FLEXIBLE MANUFACTURING SYSTEMS** **L T P C**

3 0 0 3

OBJECTIVES:
* To understand the Modern manufacturing systems
* To understand the concepts and applications of flexible manufacturing systems

UNIT I   PLANNING, SCHEDULING AND CONTROL   9
Introduction to FMS– development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility –single product, single batch, n – batch scheduling problem – knowledge based scheduling system.

UNIT II   COMPUTER CONTROL AND SOFTWARE   9
Introduction – composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends.

UNIT III   FMS SIMULATION AND DATA BASE   9
Application of simulation – model of FMS– simulation software – limitation – manufacturing data systems – data flow – FMS database systems – planning for FMS database.

UNIT IV   GROUP TECHNOLOGY AND JUSTIFICATION OF FMS   9
Introduction – matrix formulation – mathematical programming formulation –graph formulation – knowledge based system for group technology – economic justification of FMS- application of possibility distributions in FMS systems justification.

UNIT V   APPLICATIONS OF FMS AND FACTORY OF THE FUTURE 9
FMS application in machining, sheet metal fabrication, prismatic component production – aerospace application – FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future.

TOTAL: 45 PERIODS

TEXT BOOK:
1.   Jha.N.K., "Handbook of flexible manufacturing systems", Academic Press Inc., 1991.

REFERENCE BOOKS:
1.   Radhakrishnan P. and Subramanyan S., "CAD/CAM/CIM", Wiley Eastern Ltd., New Age International Ltd., 1994.
2.   Raouf A. and Daya B.M., "Flexible manufacturing systems: recent development", Elsevier Science, 1995.
3.   Groover M.P., "Automation, production systems and computer integrated manufacturing", Prentice Hall of India Pvt., New Delhi, 1996.
4.   Kalpakjian S.,"Manufacturing Engineering and Technology",Addison-Wesley Publishsing Co., 1995.
5.   Ohno T., "Toyota production system: beyond large-scale production", Productivity Press (India) Pvt. Ltd., 1992.

ME8EI   **ADDITIVE MANUFACTURING TECHNOLOGY**   **L T P C**

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OBJECTIVES:

•   To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies

•   To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.

UNIT I   INTRODUCTION   10

Overview – History - Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling - Applications.

UNIT II   CAD & REVERSE ENGINEERING   10

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing –Tool path Generation – Softwares for Additive Manufacturing Technology: MIMICS, MAGICS.

UNIT III   LIQUID BASED AND SOLID BASED SYSTEMS   10

Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing.

UNIT IV   POWDER BASED SYSTEMS   10

Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.

UNIT V   MEDICAL AND BIO-ADDITIVE MANUFACTURING   5

Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies

                                                TOTAL : 45 PERIODS

TEXT BOOKS:

1.   Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third edition, World Scientific Publishers, 2010.
2.   Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.

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1.   Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2007.
2.   Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
3.   Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2000.