www.engineeringstuff.in

Class : TE (Production Engineering)

Subject : Design of Jigs and Fixture

University of Mumbai			
CLASS : TE (PRODUCTION ENGINEERING)			Semester - V
Subject : Design of Jogs and Fixture			
Periods per week 01 Period of 60 min		Lecture	4
		Practical	2
		Tutorial	---

		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical Examination	---	--
	Oral Examination	---	25
	Team Work	---	25
	Total	--	150

Module No.	Details	Hrs
01	Component Analysis Operation planning, sequencing of operations, locating faces, geometry, accuracy, material, machinability, quantity modifications so as to assist production.	04
02	Design Analysis Selection of location and clamping faces / points , component distortion under clamping and cutting forces, compensation for component variation, choice cutting tools and means of guiding ans dupporting Jigs and Fixture details, jacks and supporting devices, drill and tool guide bushes, multiple clamping and equalizing devices, quick acting clamping mechanisms such as link, toogle, cam, eccentric , pneumatic, hydraulic and electric devices. Mathematical derivations & Numerical on them for clamping elements.	16
03	Types and construction of jigs and fixture Cast, fabricated and welded; standard components and details, cost consideration with respect to quantity, quality and effectiveness. Economics & Costing of Jigs & fixtures.	05
04	Jigs and fixture, Principles of design and construction with reference to interchangeability , simplicity, ease of operation, economy of motion, rigidity, durability, swarf disposal, study of typical examples and geometric location . Design applications of typical jigs and fixtures-plate, channel, latch	10

	and box type drill jigs and jigs for drilling combined with reaming tapping, counterboring and spot facing.	
05	Milling fixtures including multistation and indexing types (for given component). Fixture for turning and grinding operations if needed balancing of the fixture design using computer software.	08
06	Case studies for practice for jigs & Fixtures.	05

Term Work :

1. At least three different designs and drawings based on the above syllabus.
2. Assembly drawings of a simple jig or fixture using computer software Autocad or any other CAD software.
3. At least one class test to be conducted at the middle of the semester for 10 marks.

The drawings for jigs and fixtures should contain all the tolerances and materials including heat treatment.

Text Books :

1. Jig and Fixture Design Manual by Erik K. Henrikson, Industrail Press, 1973
2. An introduction to jig and tool Design by M.H.A. – Kempster, III Ed.Pub ELBS 1985
3. Jigs and Fixtures by P.H. Joshi, TNh 1988
4. Tool design by C. Donaldson, George H. Lecain, V.C. Goold, THM 1980

Reference Books :

1. Jigs and Fixture Handbook by A.K. Goroshkin, Mir Publication, 1988
2. Jigs and Fixture by ASTME
3. Non – Standards Calming Devices. By Hiran E. Grant TMH, New Delhi 1989.

----------**********----------

University of Mumbai			
CLASS: T.E. Information Technology		**Semester - V**	
SUBJECT: Environmental Studies			
Periods per week (each of 60 min.)	Lecture	2	
	Practical	-	
	Tutorial	1*	
		Hours	Marks
Evaluation System	Theory Examination	2	50
	Practical examination	-	-
	Oral Examination	-	-
	Term Work	-	25
	Total		**75**
* Class wise Tutorial			

Objective: This course is to create environmental awareness, of variety of environmental concerns.

Module	Contents	Hrs
1	The Multidisciplinary nature of environmental studies Definition, scope and importance Need for public awareness	1
2	Natural resources Renewable and non-renewable resources Natural resources & associated problem. a. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. b. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d. Food resources: World food problems overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	4
3	• Ecosystems • Concepts of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem.	3

	• Ecological succession. • Food chains, food webs and ecological pyramids. • Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)	
4	Biodiversity and its conservation • Introduction-Definition: genetic species and ecosystem diversity • Bio-geographical classification of India • Value of biodiversity : Consumptive use, productive use, social, ethical, aesthetic and option values • Bio-diversity at global, national, local levels • India as a mega diversity nation • Hot spots of bio-diversity • Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts • Endangered and endemic species of India • Conservation of biodiversity: In- situ and Ex-situ conservation of biodiversity	4
5	Environmental Pollution Definition – • Causes, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear Hazards • Solid waste management: Causes, effect and control measures of urban and industrial wastes • Role of an individual in prevention of pollution • Pollution case studies • Disaster management: floods, earthquake, cyclone and land slides	4
6	Social issues and environment • From unsustainable to sustainable development • Urban problems related to energy • Water conservation, rain water harvesting, watershed management • Re-settlement and rehabilitation of people: Its problems and concerns. Case studies. • Environmental ethics: issues and possible solution • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. • Wasteland reclamation • Consumerism and waste products • Environment protection act • Air(Prevention and control of pollution) act • Water (Prevention and control of pollution) act • Wildlife protection act	4

	• Forest conservation act • Issues involved in enforcement of environmental legislation • Public awareness	
7	Human population and the environment • Population growth, variation among nations • Population Explosion- family welfare program • Environment and human health • Human rights • Value education • HIV/AIDS • Women and child welfare • Role of information technology in environment and human health • Case studies	4
8	**Understanding Existence and Co-existence** Interrelation and Cyclicity between Material order, Bio-order, Animal order and Human order **Understanding the human conduct:** Relationship in Family, Justice in Relationship, Relationship of Human with Nature (Environment), Human Behavior, Human Values, Nature and Morality **Understanding the human society** Dimensions of Human Endeavor and Objectives, Interrelationship in Society, Mutual Fulfillment and Cyclicity in Nature.	6

Theory Examination:

1. Question paper will be comprising of total 7 questions, each of 10 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and covering the all modules.
4. Remaining questions will be mixed in nature. (e.g.- suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
5. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Term work:

Term work shall consist of minimum five projects (PROJECTS SHALL BE DESIGNED ON THE SAME GUIDE- LINE OF GIVEN TEXT BOOK) and a written test.
The distribution of marks for term work shall be as follows,
Laboratory work (Tutorial/Project and Journal) : 15 marks.
Test (at least one) : 10 marks.
The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Recommended Books:

1. Erach Bharucha, text book of environmental studies, Universities Press/Orient Blackswan
2. Jagdish Krishnaswami, R J Ranjit Daniels, 'Environmental Studies", Wiley India Private Ltd. New delhi
3. Anindita Basak, 'Environmental Studies", Pearson
4. Deeksha Dave, "Text book of , 'Environmental Studies", Cengage learning, Thomason India edition
5. Benny Joseph , 'Environmental Studies", Tata McGRAW HILL
6. D L Manjunath, , 'Environmental Studies",Pearson
7. R Rajgopalan, , 'Environmental Studies", Oxford
8. Alok Debi, 'Environmental science and Engineering", University press
9. A. Nagraj, Jeevan Vidya- A Primer.

www.engineeringstuff.in

Class : TE (Production Engineering)

Subject : Metrology and Instrumentation

University of Mumbai			
CLASS : TE (PRODUCTION ENGINEERING)			Semester - V
Subject **:** Metrology and Instrumentation			
Periods per week 01 Period of 60 min		Lecture	4
		Practical	2
		Tutorial	---

Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical Examination	---	25
	Oral Examination	---	25
	Team Work	---	25
	Total	--	175

Module No.	Details	Hrs
01	Introduction to metrology: Need for inspection, precision and accuracy, fundamental principles and definition, standards of measurement, line end and wave length standards, primary and tertiary standards	08
02	Limits, fits and Tolerances of interchangeable manufacture, allowance and tolerance, limits and fits, hole based and shaft based systems IS 919 : 1963 tolerance grades IT 01 to IT 05, types of fits, general requirements of go & NO GO gauging, Taylor's principle, Design of go & no go gauges.	08
03	Comparators : Need for comparators, amplifying system, mechanical, mechanical-optical, electrical, electronic and pneumatic comparators, principle, construction and operation of various comparators, advantages, limitations and application of above comparators.	05
04	Interferometry : Principles of interface, monochromatic source, concept of flatness, flatness testing, optical flats, interference patterns and their significance, optical interferometer, laser interferometer. Surface texture Measurement : Profile geometry, importance of surface condition, roughness and waviness, definition and significance of terms, band width selection, roughness standard specifying surface roughness parameters. Ra Ry RZ etc . RMS value, surface roughness measuring instruments such as	10

	Tomlinson surface meter. Taylor Hobson Talysurf, Measuring Surface roughness, symbols	
05	Measurement of Screw Threads : types of screw threads, definitions, measurement of major and pitch diameter, tow wire and three wire methods, floating carriage micrometer and their applications. Measurement and gauging of gears : types of gears, gear terminology and standard proportions : pitch circles diameter, circular pitch, diametral pitch and module, base pitch, addendum, dedundum, circular pitch, tooth thickness and width, base tangent method , gear tooth comparator, gear measurement using rollers, master gears and Parkinson tester.	14
06	Special Measuring Machine and Methods : Profile Projector, 3D coordinate measuring machine, Tool Maker's Microscope. Mechanical Measurements and instrumentation : Transducers (applications only) for measurement of displacement, velocity, acceleration, force, torque, temperature and fluid flow.	08

Term Work :

1. At least one class test must be conducted in the middle of the semester & 10 marks. Weightage msut be assigned during evaluation work.
2. At least six experiments based on the above syllabus and a report of laboratory work
3. Design and drawing of following types of gauges
   I) "Go" and "No GO" gauges for external dimensions.
   II) "Go" and "No Go" gauges for internal dimensions.

References :

1 Metrology by Shotbolt
2. Practical Engineering Metrology by K.W.P Sharp
3. Engineering Metrology by I.C. gupta
4. Experimental Methods for engineers by J.P. Holman
5. Instrumentation Devices and System by C.S. Rangan, G.R. Sarma, v.S. Mani TMH
6. Industrial Instrumentation and Control by S.K. Singh TMH

----------**********----------

www.engineeringstuff.in

Class : TE (Production Engineering)

Subject : Machining Science And Technology

University of Mumbai			
CLASS : TE (PRODUCTION ENGINEERING)			Semester - V
Subject : Machining Science And Technology			
Periods per week 01 Period of 60 min		Lecture	4
		Practical	2
		Tutorial	---

		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical Examination	---	--
	Oral Examination	---	25
	Team Work	---	25
	Total	--	150

Module No.	Details	Hrs
01	Mechanics of metal cutting various types of chips, Discontinuous , continuous. With built up edge, shear plane and shear plane angle Cutting ratio, orthogonal cutting and oblique cutting. Merchant's curves of forces and expression of shear stress and strain, normal forces, shear plane in terms of measurable cutting forces and shear plane angle, velocity relations. $\Phi = \frac{\pi}{4} - \frac{(\lambda - \alpha)}{2}$ Merchant's Theory $\Phi = C \quad \frac{(\lambda - \alpha)}{2}$ Merchant's Modified Theory $\Phi = \frac{\pi}{4} - \frac{\lambda}{2} + \frac{\alpha}{2}$ Earnst-Merchant's equation **Cutting forces** : Gross power, net power in machining, efficiency of machine tools. Tangential cutting force, effect of speed, feed, depth of cut, tool material and angles, material variables on cutting forces empirical formula for estimating	

	cutting forces and power, concept of specific power consumption and metal removal factor **Surface finish :** Height of feed ridges and built up edge as primary factors effecting surface finish, effect of speed, feed, depth of cut tool material and angle and material variables on surface finish. **Coolant :** Function of coolant, effects on cutting forces , tool life and surface finish, types of coolants, choice of coolants for various machining processes. **Materials for cutting tools** : Properties of cutting tool materials. Carbon tool steel, plain and alloyed, oil hardening, water hardening properties, fields of application, limitations, high speed steel standard and special H.S.S, properties, fields of application and limitations. Ceramics, Manufacturing method, properties, different compositions, fields of applications and limitations.	
02	**Tool life Definition,** flank wear and crater wear, preliminary failure and ultimate failure mechanism of tool wear, effect of speed, feed depth of cut, tool material and geometry on tool life. Taylor's tool life equation . Taylor exponent and constant, Experimental methods to find Taylor exponents. **Economics of machining** : Components of machining cost, machine cost, non production cost, tool cost, tool inventory cost, tool depreciation cost, optimum cutting cost of production.	06
03	**Design of cutting tools** : Nomenclature of Single point tools. Machine , reference and Tool Reference Systems, definition of various angle of single point tool as per Machine Reference and Tool Reference Systems. (American nomenclature will be followed in future discussion), inter relationship among different systems of nomenclature for tool angles. Factors influencing the choice of shape, size and angle of single point , cutting tool point for various machining conditions, constructional features of solid tool, tipped tools , mechanically held regrind able insert type tools throw away tip type tools. Design of shanks and cutting part details for HSS and Carbide tools.	06
04	Form Tools : Various types such as flat form tool, tangential form tool, circular form tool, constructional details and fields of application, profile correction in all types of form tools	

	with and without rake angle. **Broaches :** Details and nomenclature, design steps for pull and push broaches, design of internal and external broaches.	
05	**Drills :** Constructional features of two fluted drills, nomenclature, choice of point angle, helix angle for different machining conditions rake and clearance angles in drills, wen thinning margin relieving, double point angle, spiral lip and special grinding to reduce the effect of chipset edge , carbide tipped drills, design features of core drills, countersinks, counter bores and spot facers. **Reamers** : Constructional features of hand reamer machine reamer, adjustable reamer, expansion reamer, carbide tipped and insert type nomenclature. Design of Reamer diameter, chamfer, choice of helix angle, number of teeth, tool form, back taper, shank etc. **Taps :** hand taps and machine taps, constructional features, nomenclature, design of thread profile, number of flutes, flute shape, chamfer, length, helical fluted taps, collapsible taps.	
06	**Milling cutters** : Peripheral milling cutters, various types, choice of diameter and number of teeth, rake angle, clearance and form of flutes, helix angle of flutes and relief angle, form milling cutters, design of form relieved milling cutters, Constructional features, nomenclature, design of thread profile, number of flutes, flute shape, chamfer, length, helical fluted taps, collaspsible taps. Face Milling Cutters : Solid and inserted blade type, nomenclature of design of form relieved milling cutters. Constructional features of inserted blade milling cutters. **Face Milling Cutters :** Solid and inserted blade type, nomenclature of details and angles, selection of angles, diameter and number of teeth, constructional details of inserted blades, throwaway tip type face mills, constructional features of end mill cutters. **Gear Teeth Cutters :** Gear milling cutters, standard set of cutters, limiatations on accuracy, design of gear teeth milling cutters both disc and end mill type cutters. **Gear hobs** : Design of rake profile, lead, straight and helical	10

	gears, diameter and length of hobs, pre-shave, pre-grinding, semi topping full topping hobs, carbide tipped hobs. **Gear shaper cutters :** Disc type and shank type cutters, details and angles, pre – shave, pre-grinding , semi topping cutters**.**	

Term Work :

1. At least one class test must be conducted in the middle of the semester & 10 marks weight age must be assigned during evaluation of term work.
2. Design and drawing of minimum three cutting tools.
3. At least five numerical problems on metal cutting.
4. Experiments on any tow machine tools for determining cutting forces and studying chip formation.

Text Books :

1. Metal Cutting Theory & Practice by Sen and Bhattacharya new Central Book Agency, 1969
2. The Machining of Metals by Aamarego and R.H. Brown, Prentice Hall Inc 1969
3. Metal cutting and Tool Design by Arshinov
4. Typical Examples and Problems in Metal Cutting by N. Nefedov, K.Osipov, Mir Publishers , 1987
5. Production Technology by HMT Handbook, TMH
6. Metal Cutting Principles by Shaw, Milton, oxford Uni Press 2004

Reference Books :

1. Fundamentals of Metal Machining and Machine tools by G. Boothroyd , Tata McGraw Hill, 1975
2. ASM Handbook, Vol 6 , Machining, printed in USA , 1999
3. Metal Cutting and Machine tools by Juneja and Shekho, Wiley
4. Exp. Methods in Metal Cutting by V.c. Venkatesh, PHI, 1982

----------**********----------

www.engineeringstuff.in

Class : TE (Production Engineering)

Subject : Materials Technology

University of Mumbai			
CLASS : TE (PRODUCTION ENGINEERING)			Semester - V
Subject : Materials technology			
Periods per week 01 Period of 60 min		Lecture	4
		Practical	2
		Tutorial	---

		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical Examination	---	--
	Oral Examination	---	25
	Team Work	---	25
	Total	--	150

Module No.	Details	Hrs
1	***Structure of Materials*** 1.1 Solidification and structure of metals 1.1.1 Formation of solids from liquids of pure metals and alloys, ingot defects and their remedies. 1.1.2 Single crystal and polycrystalline structure. Classification of crystal system, crystal structure, unit cell, co-ordination number, atomic packing factor, crystallographic notations. 1.2 Crystal imperfection. 1.2.1 Definition, classification, Point defects, vacancy, interstitial, impurity atoms, their formation and effects. Dislocations : Edge and screw dislocations, their significance. Surface defects : Grain boundary, sub-angle grain boundary, stacking fault and their significance 1.2.2 Dislocation generation at Frank Reed sources, Edge-Screw Dislocation interactions. 1.3 Deformation 1.3.1 Mechanism of deformation, critical resolved shear stress, Slip systems of FCC, BCC, HCP metals. 1.3.2 Elastic deformation & Plastic deformation and their	11

	significance. 1.3.3. Deformation in Single and Polycrystalline materials , strain Hardening and its significance. Strain Hardening and its significance.	
2	**Ferrous Materials :** 2.1 Classification of Steels: Plan Carbon Steels, High Strength, Low Alloy Steels, Tool Steels, Stainless Steel, Managing Steels, Creep Resistant Steels and Steels for low Temperature Applications. ISI Designations. 2.2 Classification of Cast Irons: Gray, Malleable, Nodular, Meehanite and other Alloy Cast Irons< ISI Designations. 2.3 Engineering & other Applications of Ferrous Materials : Construction, Automobile, Marine, Aerospace, Electrical, Electronics & Telecom Engineering, chemical & General Engineering	07
3	**Heat Treatment of Steels** 3.1 Iron-Iron Carbide diagram – Steel and Cast Iton portions of Iron-Iron Carbide diagram, application of Lever Rules. Formation of Ferrite, Austenite, Pearlite and ledeburite 3.2 TTT and CCT diagrams and their industrial significance Formation of Bainite and Martensite. 3.3 basic Heat Treating Processes : Annealing, Normalizing, Hardening, tempering, Aus-tempering, Mar-tempering and Maraging 3.4 Basic Surface Hardening Processes : Carburing, Nitriding, Cyaninding, Fflame Hardening and Induction Hardening	07
4	**Non Ferrous Materials, Alloys & Theory of alloying :** **Basic Treatment Only** 4.1 Important non ferrous amterials like Aluminum, Brass, Copper, Nickel, chromium, tin, Zinc – their properties and applications. 4.2 Phase diagrams and their importance : Eclectic, Eutectoid, Peritectic and Solid Solution type of alloys, Intermediate alloys. 4.3 Important alloys of aluminum, copper, titanium, Brass,	06

	Beryllium, nickel, tin and zinc with applications.	
5	**Non Metallic materials** 5.1 Ceramics 5.1.1. Definition, Comparative Study of Structure and Properties of Engineering Ceramics with reference to Metallic Materials, Toughening Mechanisms in ceramics. 5.1.2 Applications of Engineering Ceramics : Glass and Glass Ceramics, Aluminum Oxide, Silicon Carbide, Silicon Nitride, titanium Carbide, Titanium Nitride, Zirconia and Refractories 5.2 Polymers 5.2.1 Definition : Types and classification, Comparative Study of Structure and Properties 5.2.2 Important characteristics, properties and Applications of Polymers, polyethylene, PP, ABS, Polyamides (Nylon), polycarbonates, PPS, Ploy acetal, Polyesters, acrylics, Silicons, PEK and PEEK Epoxies, Phenolics & Polyurethones.	05
6	**Structured Formulations** 6.1 Composites 6.1.1 Definition, classification, Particle-reinforced Composites and Fiber-reinforced Composites, rule of Mixtures, Sandwich Structures. 6.1.2 Applications of Composites: GFRP composites (PMC) Al_2O_3 in Al-alloy (MMC) and carbon Fiber in carbon (CMC) Fundamental understanding only. 6.2 Nano-structured Materials . 6.2.1 Definition and Introduction to Nano-Technology Unique features of Nano-structured Materials. 6.2.2. Classification of Nanao-intermediates & Nano-composites (Fundamental understanding only) 6.3 Powder Metallurgy 6.1.1 Powder manufacturing and powder compaction, Sintering, Slip Casting 6.1.2 Applications and limitations of Powder Metallurgy.	10

Term Work :

1. Based on the above syllabus at least six experiments to be conducted and the written report to be submitted with inferences.
2. At least four assignments to be undertaken in the form of an in-depth technical write-up on topics drawn from the above syllabus.
3. One class test to be conducted in the middle of the term for 10 marks.
4. Performance in experiments, assignments and class test to be taken in consideration while evaluating the term work.

Text Books :

1.	Mechanical Metallurgy	By	G.E. Dieter
2	Engineering Physical Metallurgy	By	Y.Lakhtin
3	Metallurgy for Engineers	By	E.C. Rollason
4	Introduction to Engineering Materials	By	E.C. Rollason
5	Engineering Metallurgy Part I & Part II	By	B.K. Agarwal
6	Material Sciences	By	S.L. Kakani & A. Kakani
7	Material Technology	By	S.B. Barve
8	Material Sciences and Engineering	By	V.Raghavan
9	Engineering Materials	By	C.P. Sharma
10	The Science and Engineering of Materials	By	D.R. Askeland & P.P. Phule
11	Am Introduction to Materials Engineering	By	Brian S. Mitchell (2004)
12	Science for Chemical and Materials ISBN-0471436232, 978047143623		

----------**********----------

www.engineeringstuff.in

Class : TE (Production Engineering)

Subject : Computer Aided Design and Finite Element Analysis

University of Mumbai			
CLASS : TE (PRODUCTION ENGINEERING)			Semester - V
Subject : Computer Aided Design and Finite Element Analysis			
Periods per week 01 Period of 60 min		Lecture	4
		Practical	2
		Tutorial	---

		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical Examination	---	25
	Oral Examination	---	--
	Team Work	---	25
	Total	--	150

Module No.	Details	Hrs
1 1.1 1.2	***Computer Aided Design*** Introduction : Need and Utility of CAD systems in industry, Product Cycle, Definition of CAD tools based on their Constituents and Implementation in a design environment. ***CAD Hardware :*** Types of systems, system considerations, I/O devices, Hardware Integration & Networking	04
2 2.1	***Computer Graphics*** : Pixel plotting, Scan conversions of lines & circuits, 2D & 3D transformation, 2D Viewing and clipping, Parallel Projection Elementary treatment of Hidden lines and surfaces, Cubic spines Bezier curves & B-spines, Animation, Color models	14
3 3.1	***Solid Modeling :*** Types of representation of solid models, interactive tools available with solid modeling software's. Introduction to surface modeling ***CAD DATA Exchange*** : File Structure and format of IGES, STEP, DXF	03

3.2	***Introduction to rapid Prototyping***	
4 4.1 4.2 4.2.1 4.2.2	***Finite Element method :*** ***Introduction :*** General procedure of finite element method. Applications to structural analysis and Manufacturing processes. ***Static Analysis :*** ***Formulation :*** Based on Principal of stationary total potential 1-D FEA : Generic form of FE equations for linear & quadratic bar and Beam Elements . 2-D FEA : Dimensionality of a problem, simple three nodded triangular elements, four nodded rectangular elements. Natural coordinates and coordinate transformation 2D element formulation for structural analysis to derive Stress-displacement and Stress strain matrix, Numerical integration by Gauss quadrature method, Meshing and Compatibility of elements , Incorporation of boundary conditions and solution of static equations.	18
5 5.1 5.2	***Introduction to Dynamic***, Thermal analysis and computational Fluid Dynamics FEM Dynamic Analysis using FEM (No numerical) ***Equations of motion*** and formulation of F.E. equations using 1D element for vibration problems (Introductory) ***Thermal Analysis using FEM (No Numerical)*** Basics steps for Thermal Analysis, Importance of Thermal analysis giving practical steady state conduction and convection examples. E.g. Pin fin, Expansion of railway track. Flow through engine water jacket, Heat Exchanger etc. Computational Fluid Dynamics using FEM (No Numerical) The Navier – stokes equations : The continuity equation and law of conservation of mass and their application to CFD Typical Applications e.g. Aerospace Engineering, Automobile Engineering	04
6	***FEA Software*** : Features of commercial soft ware's Preprocessor, solver and Postprocessor Types of elements available with commercial software for different FEA applications (No Numerical)	02

Term Work :

1. Assignments on each topic.
2. 3-D modeling and Assembly using any suitable software.
3. Simulation of Mechanism(kinematics) using any suitable software
4. Static And Dynamic analysis of structures
5. One class test

Text Books :

1. Mastering CAD – CAM by Ibarahim Zeid (Tata-Mcgraw-Hill)
2. Computer Graphics by ISRD group
3. Finite element alaysis by P.SESHU (Prentice Hall of India)

Reference Books :

1. CAD / CAM by P.N. Rao (Tata-Mcgraw- Hill)
2. Mathematical and Procedural Elements for computer graphics by Roger and Adams
3. Computer Graphics by Hearn and Baker (PHI)
4. Computer Graphics by Plastock and Gordon (Schamums outline series)
5. FEM by Fagan
6. FEM by J.N.Reddy (McGraw – Hill)
7. A first course in FEM by daryl L.Logon(Cengage)
8. Concepts and applications of FEA by Cook, Malkus (Jhon-wiley)

----------**********----------