Detailed Syllabi Book

Detailed Syllabi for Post Graduate Course of
Mechanical Engineering (CAD-CAM),
Faculty of Technology,
Dharmsinh Desai University, Nadiad – 387001
Gujarat state, India.
Website: *http://www.ddu.ac.in*

Dharmsinh Desai University
Faculty of Technology
Department of Mechanical Engineering

TEACHING SCHEME FOR THE COURSE

M.TECH. (CAD-CAM)

Semester-I

Course Title	Teaching Scheme					
	Th	Tut	Prac	L+T	P	Credits
ADVANCED MACHINE DESIGN	4	0	2	4	1	5.00
COMPUTER AIDED DESIGN	3	0	4	3	2	5.00
COMPUTER AIDED PRODUCTION MANAGEMENT	4	0	0	4	0	4.00
ADVANCED MATERIALS AND MANUFACTURING TECHNOLOGIES	4	0	0	4	0	4.00
ELECTIVE –I	4	0	2	4	1	5.00
SEMINAR – I	0	1	0	1	0	1.00
	19	**1**	**8**			**24.00**

Semester-II

Course Title	Teaching Scheme					
	Th	Tut	Prac	L+T	P	Credits
FINITE ELEMENT METHODS	3	0	4	3	2	5.00
COMPUTER AIDED MANUFACTURING	4	0	2	4	1	5.00
DESIGN OF HYDRAULICS AND PNEUMATICS SYSTEM	3	0	4	3	2	5.00
ELECTIVE – II	4	0	2	4	1	5.00
ELECTIVE – III	4	0	2	4	1	5.00
SEMINAR – II	0	1	0	1	0	1.00
	18	**1**	**14**			**26.00**

Semester-III

Course Title	Teaching Scheme					
	Th	Tut	Prac	L+T	P	Credits
DISSERTATION PRELIMINARIES	0	0	16	0	8	8.00
SEMINAR	0	0	4	0	2	2.00
	0	**0**	**20**			**10.00**

Semester-IV

Course Title	Teaching Scheme					
	Th	Tut	Prac	L+T	P	Credits
DISSERTATION	0	0	24	0	12	12.00
	0	**0**	**24**			**12.00**

Dharmsinh Desai University
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Department of Mechanical Engineering

ELECTIVE-I
PRODUCT DESIGN AND DEVELOPMENT
MECHANICAL VIBRATION
OPTIMIZATION TECHNIQUES IN ENGINEERING

ELECTIVE FOR SEMESTER-II
ROBOTICS
MODELING AND SIMULATION
RELIABILITY, AVAILABILITY AND MAINTAINABILITY
DESIGN OF MATERIAL HANDLING EQUIPMENTS
RAPID PROTOTYPING AND TOOLING
MECHATRONICS IN MANUFACTURING SYSTEMS
ADVANCED TOOL DESIGN
TRIBOLOGY IN DESIGN
ARTIFICIAL INTELLIGENCE

Dharmsinh Desai University
Faculty of Technology
Department of Mechanical Engineering

M.TECH. SEMESTER – I (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: ADVANCED MACHINE DESIGN
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1. **Stress and Strain analysis:**
   Basic analysis of stress and strain with applications.
2. **Theories of failure:** Different types of theories of failures and its significance. Design for fluctuating stresses for limited and multiple stress cycles with applications.
3. **Surface failures:**
   Surface geometry, mating surfaces, oil film and their effects, design values and procedures, adhesive wear, abrasive wear, corrosion wear, surface fatigue, different contacts, dynamic contact stresses, surface fatigue failures, surface fatigue strength.
4. **Fatigue and creep:**
   Introduction, Fatigue strength, factors affecting fatigue behavior, Influence of super imposed static stress, Cumulative fatigue damage, fatigue under complex stresses, Fatigue strength after over stresses, True stress and true strength, mechanism of creep of material at high temperature, Exponential creep law, hyperbolic sine creep law, stress relaxation, bending etc
5. **Engineering statistics**
   Analysis of variance (ANOVA), factorial design and regression analysis. Reliability theory, design for reliability, Hazard analysis, fault tree analysis
6. **Economic factors influencing design**: Economic analysis, Break-even analysis, Human engineering considerations, Ergonomics, Design of controls, Design of displays. Value engineering, Material and process selection in value engineering.
7. **Introduction to DFMA:** Introduction to different manufacturing processes, Introduction to material and material selection, mechanical properties of materials. Design guidelines for various manufacturing processes.

TERM WORK:

Term work shall be based on above mentioned syllabus topics.

Reference Books:

1. L S Srinath, Advanced Solid Mechanics - Tata McGraw-Hill.
2. S P Timoshenko and J N Goodier, Theory of Elasticity – McGraw-Hill.
3. Robert L. Norton, Machine Design An Integrated Approach - Prentice-Hall New Jersey, USA.
4. J.E. Shigley and L.D. Mitchell, Mechanical Engineering Design - McGraw-Hill International Book Company, New Delhi.
5. Karl T. Ulrich and Steven D. Eppinger, Product design and development. 3rd edition, -Tata McGraw Hill.
6. James G. Bralla, Product design for manufacturing.
7. A.K.Chitare and R.C.Gupta, Product design and manufacturing - Prentice-Hall of India, New Delhi.
8. James G. Bralla , Design for manufacturing Handbook - McGraw-Hill, U.S.A.

Dharmsinh Desai University
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Department of Mechanical Engineering

M.TECH. SEMESTER – I (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: COMPUTER AIDED DESIGN
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
3	0	4	60	40	25	25	150

SYLLABUS

1. **FUNDAMENTALS OF CAD:**
   Introduction to CAD, Conventional design v/s Computer aided design, Interactive computer graphics, CAD workstation, Hardwares used in CAD, CAD softwares, CAD programming.
2. **COMPUTER GRAPHICS:**
   Scan conversion, Algorithms to generate various 2D geometries such as line, circle etc.
3. **GEOMETRIC TRANSFORMATION:**
   Various 2D geometric transformation, Homogeneous coordinate system, Inverse transformation, Composite transformation, Coordinate transformation, 3D geometric transformation, Projections of geometric model such as Orthographic Projections, Isometric Projections, Perspective Projections etc.
4. **GEOMETRIC MODELLING:**
   Introduction to geometric modeling, Wireframe modeling, Analytical and Synthetic curves, Representation of curves, Non-Parametric representation, Parametric representation, Parametric representation of analytical curves, Parametric representation of synthetic curves, Introduction to NURBS.
   Analytical and Synthetic surfaces, Parametric representation of surfaces.
   Geometry and topology data of solid model, Representation schemes of Solids-Generalized sweeps, Spatial Occupancy enumeration, Cellular decomposition, Constructive solid geometry (C-Rep), Boundary representation (B-Rep), etc. Feature based modeling, Parametric representation of solids.
   Assembly modelling – top down and bottom up modelling concept.
5. **CAD STANDARDS:**
   Need of CAD data exchange, CAD standards such as IGES, PDES, STEP etc., CAD/CAM Integration trough data exchange standards.
6. **REVERSE ENGINEERING**
   Basic concept- Digitization techniques–Model Reconstruction

Term Work

Term work shall be based on the above topics.

Reference Books:

1. Hearn Donald & Baker M. Pauline, "Computer Graphics", Prentice-Hall of India Pvt. Ltd., 2nd Edition, 1997.
2. David F. Rogers & J. Alan Adams, "Mathematical Elements for Computer Graphics", McGraw Hill, 2nd Edition, 1990.
3. Haideri Farazdak, "CAD, CAM and Automation", Nirali Prakashan, 2014.
4. Zimmer & Groover, "CAD/CAM", Prentice Hall of India.
5. Mortenson, M. E., "Geometric modeling", Industrial Press, 2006.
6. Zeid Ibrahim, "CAD/CAM - Theory and Practice", McGraw Hill, International Edition, 1998.
7. Rao, P.N. "CAD/CAM: Principles and Applications", McGraw Hill Publication, 2nd Edition, 2004.
8. S. Radhakrishnan, "CAD/CAM/CIM"

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M.TECH. SEMESTER – I (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: COMPUTER AIDED PRODUCTION MANAGEMENT
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	0	60	40	0	0	100

SYLLABUS

1. **COMPUTER AIDED FORECASTING**:
   Nature and use of forecast, different forecasting methods, selection of forecasting technique, measurement of forecast Accuracy, Adoptive methods.
2. **COMPUTER AIDED FACILITY DESIGN:**
   Computerized relative allocation of facility technique, automated layout design program and computerized relationship layout planning for facility location and layout.
3. **COMPUTER AIDED PROCESS PLANNING:**
   Generative and variant types, backward and forward approach, feature based and CAD based CAPP.
4. **MRP:**
   Master Production Schedule (MPS), Materials Requirement Planning (MRP), Lot sizing in MRP Systems, Evolution from MRP to Manufacturing Resource Planning (MRP II)
5. **ERP:**
   Introduction, main features, generic model of ERP system, selection of ERP, proof of concept approach, analytic hierarchy approach, ERP implementation
6. **PRODUCTION SCHEDULING:**
   Single Machine Scheduling, Flow Shop Scheduling, Job Shop Scheduling
7. **GROUP TECHNOLOGY**:
   Part family, Part classification and coding, Production flow analysis, ROC, SLCA, cellular manufacturing, quantitative analysis in cellular manufacturing, Holier Method-I, II.

TERM WORK:
The term work shall be based on the above syllabus.

Reference Books:

1. Automation, Production Systems and Computer Integrated Manufacturing, 2nd edition, Mikell P. Groover, Prentice Hall of India, New Delhi, 2003.
2. Zimmers, Groover; CAD/CAM, 9th Ed.; Prentice Hall of India, 1998
3. Kundra, Rao, Tiwari; Numerical Control and Computer Aided Manufacturing; TMH
4. Koren Yoram; Computer Control of Manufacturing Systems, 3rd Ed.; McGrawHill, 1986
5. Modern Production/Operations Management, Elwood S. Buffa and Rakesh K. Sarin,Wiley Student Edition.
6. Production and Operations Management by R. Panneerselvam, Prentice –Hall of India Private Limited, New Delhi.
7. Facilities planning, J. A. Tompkins and J. A. White, John Wiley, 1984.
8. Plant layout &Material Handling, G. K. Aggarwal, Jain Publishers, New Delhi.

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M.TECH. SEMESTER – I (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: ADVANCED MATERIALS AND MANUFACTURING TECHNOLOGIES
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	0	60	40	0	0	100

SYLLABUS

1. **ADVANCED MATERIALS:**
   Special steels, Alloy cast iron, Super alloys, Ferro electric and piezoelectric materials, Advanced magnetic materials, Advanced engineering polymer materials, Advanced ceramic and composite materials, photo conducting and photovoltaic materials, electro-optic materials, Lasers, Biomaterials, Smart materials, Nano materials & technology.
   MATERIALS PROCESSING:
   Conventional processing techniques for advanced materials, special processing techniques, use of computers in metal processing
   MECHANICAL BEHAVIOR & SERVICE PERFORMANCE OF MATERIALS
   Behaviour: Tensile testing, other tests of plastic behaviour, strain hardening of metals, strain rate and temperature dependence, slip, Hardening mechanisms in metals, dynamic strain aging; ductility and fracture, fracture mechanics theories, Creep mechanisms, Fatigue Analysis, cyclic stress-strain behaviour, Mechanical behaviour of ceramics and glasses
   Performance: Corrosion and its control, Performance of materials at High & low temperatures, Radiation damage and recovery.
2. **ADVACED MANUFACTURING PROCESSES**
   Advanced manufacturing techniques for casting, forming, welding etc.
3. **MICRO AND NANO MANUFACTURING**
   Introduction to Micro and Nano manufacturing technology, advantages and applications of nanotechnology, Overview of Nano Fabrication Methods: Top-down and bottom-up approaches, lithography, deposition, CVD, PVD, etching, and material modification methods, processes and equipment.

References:

1. John Cobert / Adisson Wesley Design for Manufacture /, 1995.
2. ASM Handbook, Vol.20.
3. George E. Deiter - Engineering Design- A Material and Processing Approach McGraw Hill Intl., 2nd Edition, 2000.
4. Product design and Manufacturing / A.K Chitale and R.C Gupta / Prentice – Hall of India, New Delhi, 2003.
5. Design and Manufacturing / Surender Kumar & Goutham Sutradhar / Oxford &IBH Publishing Co. Pvt .Ltd., New Delhi, 1998
6. RS Mishra, Friction Stir Welding and Processing, ASM International, 2007.
7. Heine, Loper and Rosenthal, Principles of Metal Casting, TMH, New Delhi, 1995.
8. GR Nagpal, Metal Forming Processes, Khanna Publishers, New Delhi, 2000.
9. V.K. Jain, Advanced Machining Processes, Allied Publishers, Mumbai, 2002.
10. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
11. Z. Cui, Nanofabrication, Springer, 2008.
12. Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta and John J. Moore, Introduction to Nano science and Nanotechnology, CRC Press, Boca Raton, 2009.

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M.TECH. SEMESTER – I (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: PRODUCT DESIGN AND DEVELOPMENT (ELECTIVE-I)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1. **INTRODUCTION:**
   Importance of product design, type of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods.
2. **MATERIAL SELECTION:**
   Importance, classification, material performance characteristic, selection criteria, Ashby Material selection chart.
3. **PROCESS SELECTION:**
   Importance, types of manufacturing processes, Sources of information, selection criteria, Material and Process selection Methods, Expert systems. Computer Database Approach, performance indices, decision matrix, AHP and fuzzy approach, introduction to material and process selection software.
4. **VARIOUS CONCEPTS OF DESIGN:**
   Benchmarking, DFM, DFA, DFX, supplier involvement, robust design, Quality Function Deployment (QFD), Concurrent engineering.
5. **PRODUCT ANALYSIS AND PRODUCT ASSEMBLY:**
   Mathematics of Times Value of Money Cost Comparison, Depreciation Taxes. Inflation, profitability of Investment and Investment Decision Analysis, Sensitivity Analysis. Methods of cost Estimates, Industrial Engineering Approach, parametric Approach, Introduction to Assembly Modeling. Top-Down and Bottom-Up Approaches of AM. Mating Conditions Representation Schemes. Generation of Assembly Sequences.
6. **PROTOTYPING:**
   Product Development Cycle and Importance of Prototyping. Types of prototypes. Different Types of Generative Manufacturing process, i.e., Stereo lithography. FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Consideration.

Reference Books:

1. Product Design and Manufacturing by A.K.Chitale, R.C.Gupta, PHI.
2. Product Design and Development by Ulirich Karl T. and Eppinger Steven D, McGraw Hill.
3. Engineering Design by Dieter George E., McGraw Hill.
4. Handboook of Product Design for Manufacturing by Bralla, James G, McGraw Hill.

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M.TECH. SEMESTER – I (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: MECHANICAL VIBRATION (ELECTIVE-I)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1. **Introduction:**
   Characterization of engineering vibration problems, Review of single degree freedom systems with free, damped and forced vibrations.
2. **Two-degree of Freedom Systems:**
   Principal modes of vibration coordinate systems, various two degree of freedom systems, coordinate coupling, vibration absorbers.
3. **Multi-degree Freedom systems:**
   Free vibration equation of motion, influence coefficient i) stiffness coefficient (ii) flexibility coefficient generalized coordinates ,Eigen-value problem, Close coupled and far coupled systems, Orthogonality of mode shapes, Modal analysis for free, damped and forced vibration systems, Approximate methods for fundamental frequency-Rayleigh's, Dunkerley's, Method of matrix iteration, Stodola and Holzer method.
4. **Continuous systems:**
   Transverse vibration of string, Longitudinal vibration of rods, Torsional vibration of shaft, Transverse vibration of beams, free and forced vibration of continuous systems, Effect of Rotary inertia and shear deformation , Vibration of plates
5. **Vibration Control and Measurement**
   Control: Balancing of rotating machine, in-situ balancing of rotors, control of natural frequency introduction of damping, vibration isolation and vibration absorbers,
   Measurement: FFT analyzer, vibration exciters, signal analysis, time domain and frequency domain analysis of signals, experimental modal analysis, machine conditioning and monitoring, fault diagnosis.
6. **Transient Vibrations:**
   Response to an impulsive, step and pulse input, Shock spectrum
7. **Non-linear Vibrations:**
   Non-linear systems, Undamped and forced vibration with non-linear spring forces, Self-excited, Stability.

TERM WORK:

Term work shall be based on the above topics.

Reference Books:

1. Theory and practice of Mechanical Vibrations J.S. Rao and K. Gupta New Age International
2. Mechanical Vibrations G.K. Groover Nem Chand & Brothers
3. Mechanical Vibration Practice V. Ramamurti Narosa Publications
4. Mechanical Vibrations V.P. Singh Dhanpat Rai & sons
5. Textbook of Mechanical Vibrations R.V. Dukkipati & J. Srinivas Prentice Hall of India
6. Theory of Vibrations with Applications, W. T. Thomson, CBS Publishers, Delhi
7. Fundamentals of Vibration, Leonard Meirovitch, McGraw Hill International Edison.
8. Mechanical Vibrations, J P Den Hartog, McGraw Hill
9. Mechanical Vibrations, A H Church, John Wiley & Sons Inc

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M.TECH. SEMESTER – I (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: OPTIMIZATION TECHNIQUES IN ENGINEERING
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1. **INTRODUCTION:**
   Introduction, Historical development, Engineering Application, Optimization Techniques, Classification
2. **CLASSICAL OPTIMIZATION TECHNIQUES:**
   Basic Concepts of Optimization-Convex and Concave Functions, Necessary and sufficient conditions for Stationary Points; Optimization of one- dimensional Functions; Unconstrained Multivariable Optimization, Multivariable optimization with equality and inequality constraint.
3. **LINEAR PROGRAMMING:**
   Introduction ,Linear Programming and its Applications; Simplex method Duality in linear programming, Decomposition Principle ,Quadratic Programming
4. **NONLINEAR PROGRAMMING :**
   Introduction, One- Dimensional Minimization Methods-Elimination methods — Unrestricted Search, Exhaustive Search, Dichotomous search, Fibonacci method, Golden Section Method, Interpolation methods,
5. **UNCONSTRAINED OPTIMIZATION TECHNIQUES:**
   Introduction, Simplex Method, Cauchy's Method, Newton Raphson Method, Quassi Newton Raphson Method,
6. **CONSTRAINED OPTIMIZATION TECHNIQUES:**
   Optimization with equality and inequality constraints, Direct methods – Indirect methods using penalty functions, Lagrange multipliers
7. **UNCONVENTIONAL OPTIMIZATION:**
   Genetic Algorithms, Simulated Annealing, Neural Network- Based Optimization, Fuzzy & Neuro-fuzzy algorithms, Ant colony Algorithms, Particle swarm optimization technique

TERMWORK:

Term-work shall be based on above topics.

Reference Books:

1. Singiresu S. Rao , 'Engineering Optimization Theory and Practice' John Wiley & Sons, Inc.
2. G.S.Beveridge and R.S.Schechter, Optimization Theory and Practice
3. G.V.Rekllaitis, A.Ravindran, and K.M.Ragsdell, Engineering Optimization-Methods and Applications
4. Deb Kalyanmoy, Optimization for Engineering Design: Algorithms and Examples
5. Unwubolu Godfrey C. and Babu B.V., "New Optimization Techniques in Engineering",
6. Reklaitis G.V., Ravindran A., and Ragsdell K. M., "Engineering Optimization Methods and applications", Wiley-Interscience, 1993.
7. T.F.Edgar and D.M.Himmelblau, Optimization of Chemical Processes
8. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen

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M.TECH. SEMESTER – I (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: SEMINAR-I
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
0	1	0	0	0	0	50	50

The students are required to prepare/present seminar on given topic.
The students will undertake Seminar work for the period of full semester. They may opt for design/develop & fabricate small innovative product.

They are supposed to prepare and submit a seminar report as a part of their term work and give presentation on their work. The faculty should monitor the students for their seminar work regularly every week. They are to be examined based on viva and/or demonstration.

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: FINITE ELEMENT METHODS
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
3	0	4	60	40	25	25	150

SYLLABUS

1. **INTRODUCTION**
   Introduction to FEM, Stresses and equilibrium, Strain displacement relationship, stress strain relation, General steps for finite element method, shape function, Types of elements, Potential energy approach- Rayleigh-Ritz method, Weighted residual method- Galerkin's method, principle of virtual work, application of finite element method, Comparison of FEM with the other methods, advantages of FEM.
2. **1D STRUCTURAL PROBLEM:**
   1D spar elements, Natural and global co-ordinate systems, linear shape function, stress-strain and displacement relationship, stiffness matrix and its properties, load vector, Boundary condition, elimination approach and penalty approach, structural problems: Axial bar elements, Thermal effects in axial bar elements, Quadratic shape function, analysis of trusses- plane truss and space truss.
3. **ANALYSIS OF BEAM, FRAME AND GRID**
   Beam stiffness matrix on Euler Bernoulli's beam theory, distributed loading, work equivalence method, Beam element with nodal hinge, rigid plane frame, concept of space frame, grid equation.
4. **2D STRUCTURAL PROBLEM**
   Principles for 2D problems- plane stress and plane strain, CST element – shape function, element stiffness matrix, LST element, quadrilateral, higher order elements, Isoparametric formulation, shape function, axisymmetric problems.
5. **STRUCTURAL DYNAMICS**
   Dynamics of spring mass system, Modal analysis, Natural frequencies and mode shapes, Evaluation of eigen values and eigen vectors, Natural frequencies of 1D bar element and beam element.
6. **SCALER FIELD PROBLEMES**
   Steady state heat transfer, one dimensional heat conduction, one dimensional heat transfer in thin fin element, 1D fluid flow analysis
7. **INTRODUCTION TO NON LINEAR PROBLEM**
   Introduction to Non-linearity: Geometric Non-linearity, Material Non-linearity, Non-linear dynamic problems.

TERM WORK:

Term work shall be based on the above topics.

Reference Books:

1. "Introduction to Finite Elements in Engineering", Tirupathi K. Chandrupatla and Ashok D. Belegundu Prentice Hall of India Private Ltd.
2. "A First Course in the Finite Element Method", D. L. Logan, Cengage Learning, McGraw Hill.
3. "CAD / Cam and Automation", Farazdak Haidery, Nirali Prakashan.
4. "Finite Element Analysis", P. Seshu.
5. "Finite Element Procedures in engineering analysis", K.J Bathe.
6. "An Introduction to Finite Element Methods", J. N. Reddy, Mc Graw Hill.
7. "The finite element methods in Engineering", S.S. Rao, Pergamon, New York.
8. "An Introduction to Nonlinear Finite Element Analysis", J.N.Reddy, Oxford University Press.
9. "The Finite Element Method in Engineering science", O.C. Zienkowicz, Mc Graw Hill.
10. "Concepts and Applications of finite element analysis", Cook Robert Davis.

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: COMPUTER AIDED MANUFACTURING
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1. **ESSENTIALS OF NC/CNC MACHINE TOOLS:**
   Fundamentals and principles of NC/CNC Machine Tools: NC, CNC, DNC. Classification of NC/CNC Machine tools, Features of CNC Systems, Specification of CNC systems. Components of NC/CNC system -Ball screws, Guideways, machine structure, drives and controls, Machine Control Unit, Transmission system, Drives and Feedback Devices, NC/CNC tooling etc.
   Nomenclature of NC machine axes, CNC Control System, Automatic tool changer, Automatic Pallet Changer
   NC part programming, Punched tape and tape formats, NC words, Manual Part Programming for turning and machining centers.
2. **FMS:**
   Introduction of FMS, Need of FMS, General Considerations for FMS, Types of FMS, Flexibilities and their measurements, various mathematical techniques for flexibility measurements. Manufacturing cells, cellular v/s flexible manufacturing, Application of JIT and GT to FMS.
3. **AUTOMATED MATERIAL HANDLING SYSTEMS:**
   Type of Material Handling System, Configuration, Equipments, Elements AGVS, ASRS, Carousal System, scheduling of AGVs,
4. **COMPUTER INTEGRATED MANUFACTURING SYSTEMS**
   Introduction to CIMS, nature, types of manufacturing system, evaluation, CIMS hardware and software, benefits, scope and needs, CIMS wheel, elements of CIMS and their role, Computer technology and manufacturing, database requirement, fundamentals of communication, data base management, database models, DBMS architecture, SQL-Steps to implement CIM, its management, personnel, emerging technologies like expert systems, lasers in manufacturing (machinery and metrology), concurrent engineering.
   CAD/CAM Integration: - Activities involved, case studies, software requirements, hardware requirements, factory automation, implementation
5. **Automatic Identification & Inspection**
   Automatic Identification
   Shop floor control – Factory data collection system, Bar code techniques, Computer for local area network,

Automated inspection

Basic principles and methods, Techniques for automated inspection– Contact and non contact inspection methods in processes, Automated measuring methods –machine vision, optical inspection methods.

TERM WORK:

Term work shall be based on the above topics.

Reference Books:

1. Mikell P. Grover, Automation., Production Systems and Computer Integrated Manufacturing, Prentice Hall of India Pvt Ltd, 1995
2. A Troisky, Principles of Automatiopn and Automated Production, Mir Publ, 1971
3. C.Ray Astaihe, Robots of Manufacturing automation, John Wiley and Sons, New York.
4. Numerical control and computer aided manufacturing – T.K. Kundra, P.N.Rao and N.K.Tewari – Tata McGraw Hill Publishing company Ltd.
5. Computer numerical control machines –P.Radhakrishnan ,New Central Book Agency
6. Flexible Manufacturing Cells and System -William. W. Luggen Prentice Hall, England Cliffs, NJ.
7. CAD, CAM and CIM – P. Radhakrishan, S. Subramaniyam , New Age International.
8. Mechatronics- Integrated Technologies for Intelligent Machines, A. Smaili and F. Mrad- Publisher- Oxford University Press
9. Vajpayee S. Kant, “Computer integrated Manufacturing ” Prentice Hall of India, 1995.
10. CAD CAM by P.N Rao
11. Vinay Patel and P.M. Agrawal, “CNC- Fundamentals and Programming”, Charotar Publication.

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Department of Mechanical Engineering

M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: DESIGN AND APPLICATIONS OF HYDRAULICS & PNEUMATICS SYSTEM
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
3	0	4	60	40	25	25	150

SYLLABUS

1. **FLUID POWER SYSTEMS AND FUNDAMENTALS:**
   Introduction to fluid power, Advantages of fluid power, Application of fluid power system, Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols, Basics of Hydraulics-Applications of Pascals Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings
2. **HYDRAULIC SYSTEM & COMPONENTS:**
   Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps, Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rod less, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors
3. **DESIGN OF HYDRAULIC CIRCUITS:**
   Construction of Control Components : Directional control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram, Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit
4. **INTRODUCTION TO PNEUMATIC CONTROL:**
   Introduction, characteristics of compressed air, selection criteria for Pneumatic control system, Advantages and disadvantages of Pneumatic control, Basic structure of Pneumatic control system.
5. **COMPRESSED AIR PREPARATION:**
   Various types of compressors for air preparation, Different types of air filters, Compressed air regulator, Compressed air lubricator.
6. **PNEUMATIC ACTUATORS:**
   Single acting actuators, Various double acting actuators like actuators with cushion, Tandem actuators, Rod less actuators, Rotary actuators, cylinder seals.
7. **PNEUMATIC CONTROL VALVES:**
   Use of directional control valves in Pneumatics, Symbolic representation of DCV, Types of DCV, Constructional details of DCV, Selection criteria of DCV, Flow control valves, Quick exhaust valve, shuttle valve, Two pressure valve, Time delay valve.

8. **CONTROLLING OF PNEUMATIC CYLINDERS:**
   Direct control of single acting cylinders, Indirect control of single acting cylinders, Methods of checking end positions, speed control of cylinders, co-ordinated motion control.

TERM WORK:

Term work shall be based on the above topics.

References Books:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill,
3. Majumdar S.R., Pneumatics Systems- Principles and Maintenance", Tata McGraw-Hill
4. Andrew Parr, Hydraulics and Pneumatics, Jaico Publishing House.
5. Srinivasan.R, "Hydraulic and Pneumatic controls", Vijay Nicole
6. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co
7. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers
8. Harry L. Stevart D.B, "Practical guide to fluid power", Taraoeala sons and Port Ltd. Broadey
9. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989
10. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: ROBOTICS (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1. **INTRODUCTION:**
   Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.
2. **CONTROL SYSTEM AND COMPONENTS**:
   Basic concept, robot activation and feedback components, Positions and velocity sensors, Linear and rotary actuators and control valves, power transmission system.
3. **MOTION ANALYSIS AND CONTROL**:
   Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.
4. **END EFFECTORS**:
   Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design.
5. **ROBOT SENSORS**:
   Desirable features, tactile, proximity and range sensors, uses sensors in robotics, Robotic vision system, Image grabbing, Image processing and analysis, Image segmentation, Pattern recognition, Training of vision system.
6. **ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS:**
   Methods of Robot Programming, Characteristics of task level languages lead through programming methods, Motion interpolation, Artificial intelligence, Basics, Goals of artificial intelligence, AI techniques, Problem representation in AI, Problem reduction and solution techniques, Application of AI and ES in Robots.
7. **ROBOT CELL DESGIN AND CONTROL**:
   Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, safety in robotics, Work and control, Inter locks, Error detection, Work cell controller.
8. **ROBOT APPLICATIONS AND RECENT TRENDS**:
   Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Multi-axis robots, intelligent robots.

TERM WORK:

Term work shall be based on the above topics.

Reference Books:

1. Introduction to Robotics Analysis, Systems, Applications by Saeed B Niku PHI.
2. A Robot Engineering text book by Moshen Shahinpoor, Harper and Row Publishers, NY.
3. Fundamentals of Robotics – Analysis and Control, Robert J Schilling, PHI.
4. Robotic technology, Principles and practice – Werner G Holz book – Van Nostrand Reinhold Co NY.
5. Robotic Engineering – An Integrated Approach by Richard D Klaffer, Thomas A Chmielewski, Michael Negin – PHI.
6. Robot Dynamics and Control – Mark W Spong, M Vidyasagar – Wiley India.
7. Intro to Robotics, Mechanics and Control by John J Craig, Pearson Education.
8. Modelling and Control of Vehicular and robotic systems by Sisil Kumararawadu, Narosa publishing house.
9. Industrial Robots by Ganesh S Hegde – Laxmi Publications.

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: MODELING AND SIMULATION (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1 INTRODUCTION:
Introduction to concept of system and environment, various types of systems i.e., Static and Dynamic systems, Continuous and discrete systems, linear and nonlinear systems etc., Introduction to modeling, Principles used in modeling. Types of models i.e., Mathematical models, Physical models, analog models and others, Estimation of model parameters.

2 SIMULATION:
Simulation techniques, experimental nature of simulation, numerical computation techniques, continuous system models; analog and hybrid simulation, Output data analysis for a single system, comparing alternative system configurations.

3 STATISTICAL APPROACH:
Statistical procedure for comparing real world observations with simulation output data, Generation of arriving processes, Verification and validation of simulation models.

4 MONTE CARLO SIMULATION:
Monte Carlo simulation and its application in queuing models and inventory models, Simulation of manufacturing and material handling system.

5 CASE STUDIES:
Mathematical modeling and simulation of various Mechanical and Electrical Systems

TERM WORK:
Term work shall be based on above syllabus.

Reference Books:

1. Law A.M. & Kelton W.D. “Simulation Modeling and Ana lysis”, McGraw Hill Publication, 1991.
2. Jerry Banks, “Discrete event System simulation”, 2nd edition, Prentice Hall of India Ltd., 2000.
3. Geoffrey Gorden, “System Simulation”, 2nd edition, Prentice Hall of India Ltd., 2007.
4. Neelam Kavil K., “Computer Simulation and Modeling”, John Wiley & Sons, 1987.
5. Dr. D. S. Hira, “System Simulation”.
6. Allan Carrie, “Simulation of Manufacturing”, John Wiley & Sons.
7. Sunil Saigal, Stefan Thynell, Harold S. Morgan, Ken Chong, “Modeling and Simulation Based Life-Cycle Engineering”, Taylor and Francis, 2001.

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: RELIABILITY AVAILABILITY AND MAINTAINABILITY (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
3	0	0	60	40	0	0	100

SYLLABUS

1. **RELIABILITY:**
   System concepts in RAM Engineering, Fundamentals of reliability, Failure distributions, Statistical analysis of failure data, Weibull analysis, Monte Carlo simulation, System reliability assessment, Reliability of repairable and non-repairable systems
   Stochastic and Markovian processes, product failure theories, reliability of parallel, standby and series products, reliability of non-maintained and maintained products, Use of signal flow graph theory for evaluating reliability. Reliability and reward, Making of more reliable products using less reliable components: "Good as New" and "Bad as Old" concepts
2. **AVAILABILITY:**
   Point, mission and steady state availability, Availability assessment
3. **MAINTAINABILITY:**
   Maintainability and its assessment, Design for reliability and maintainability, Practical applications of RAM Engineering to systems, products and processes

Reference Books:

1. Reliability Engineering Fundamentals and Applications : R. Ramakumar
2. Maintainability, Availability and Operational Readiness Engineering : Dimitri Kececelogu Vol. - I
3. Reliability Engineering : Govil
4. Reliability Engineering : Balguruswamy

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: DESIGN OF MATERIAL HANDLING EQUIPMENTS (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1. **Introduction:**
   Objectives of material handling systems; basic principles, classification, selection of material handling equipment, characteristics and applications, parameters affecting service
2. **Bulk material handling plants and conveyors**:
   Introduction to bulk material handling plants and system, bulk materials and their characteristics, belt conveyors, methods of feeding/loading belt conveyor, types of belts, design requirement in belt selection, design of idlers and pulleys, belt cleaning devices
3. **Design of Hoists**:
   Design of hoisting equipments: fibrous ropes, wire ropes, design of pulley systems, design of forged hooks and eye hooks, Bucket elevators: design of loading and bucket arrangements, design of fork lift trucks
4. **Cranes:**
   Types of cranes, Structural analysis of various types of cranes, stability of cranes
5. **Miscellaneous:**
   Unit load handling, Palletizing, Packaging, Types of storages and packaging

TERM WORK:

Term work shall be based on above mentioned syllabus topics.

Reference Books:

1. Materials Handling Equipments by N. Rudenko - Peace Publishers
2. Material handling equipment by M. P. Alexandrov - MIR Publisher, Moscow
3. Material handling by Y. I. Oberman - MIR Publisher, Moscow
4. Conveyors and Related Equipments by Spivakowsky - Peace Publishers
5. Conveying Machines by Spivakowsky and V. Dyachke - MIR Publishers
6. Belt Conveyors for Bulk Materials (2nd Ed) by Conveyor Equipment Manufacturers Association

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: RAPID PROTOTYPING AND TOOLING (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	0	60	40	0	0	100

SYLLABUS

1. **INTRODUCTION**
   Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.
2. **RAPID PRODUCT DEVELOPMENT- OVERVIEW**
   Virtual prototyping and testing technology, Physical Prototyping and Rapid Manufacturing technologies and Synergic Integration Technologies
3. **LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS**
   Stereo lithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, Three dimensional printing: Working Principles, details of processes, Products, materials, advantages, limitations and applications - Case studies
4. **POWDER BASED RAPID PROTOTYPING SYSTEMS**
   Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam melting (EBM): Processes, materials, products, advantages, applications and limitations – Case Studies.
5. **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 and Contour data organization, direct and adaptive slicing, and Tool path generation.
6. **RAPID TOOLING**
   Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect-Fabrication processes, Applications. Case studies - automotive, aerospace and electronic industries.

Reference Books:

1. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.
3. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.
4. Kenneth G. Cooper, "Rapid Prototyping Technology: Selection and Application", CRC Press, 2001.
5. Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003.
6. Ghosh A., "Rapid Protopyping: A Brief Introduction".
7. Kenneth G. Cooper, "Rapid Prototyping Technology: Selection and Application", CRC Press, 2001.

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: MECHATRONICS IN MANUFACTURING SYSTEMS (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
3	0	4	60	40	25	25	150

SYLLABUS

1. **INTRODUCTION**
   Definition of Mechatronics, Mechatronics in manufacturing, products and design. Review of fundamentals of electronics.
2. **MECHATRONICS ELEMENTS**
   Data conversion devices, sensors, micro-sensors, transducers, signal processing devices, relays, contactors and timers.
3. **PROCESSORS /CONTROLLERS**
   Microprocessors, microcontrollers, PID controllers and PLCs.
4. **DRIVES AND MECHANISMS OF AN AUTOMATED SYSTEM**
   Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.
5. **APPLICATIONS OF HYDRAULIC AND PNEUMATIC SYSTEMS**
   Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, pumps, Design of hydraulic circuits.
   Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems.
6. **CNC TECHNOLOGY AND ROBOTICS**
   CNC machines and its maintenance, Industrial Robotics.

TERM WORK:

Term work shall be based on the above topics.

Reference Books:

1. Boucher, T. O., “Computer automation in manufacturing - an Introduction”, Chapman and Hall, 1996.
2. HMT ltd. “Mechatronics”, Tata McGraw-Hill, New Delhi, 1988
3. Deb, S. R., “Robotics technology and flexible automation”, Tata McGraw-Hill, New Delhi, 1994.
4. Boltan, W., Mechatronics: electronic control systems in mechanical and electrical engineering, Longman, Singapore, 1999
5. Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ, "Mechatronics ", Chapman and Hall
6. Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ, "Mechatronics ", Chapman and Hall
7. Ramesh.S, Gaonkar, "Microprocessor Architecture, Programming and Applications” Wiley 1998.
8. Mechatronics- Ganesh S. Hegde, Published by University Science Press (An imprint of Laxmi Publication Private Limited)

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: ADVANCED TOOL DESIGN (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	0	60	40	0	0	100

SYLLABUS

1. **INTRODUCTION TO TOOL DESIGN**
   Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings –Surface finish – Fits and Tolerances – Tooling Materials- Ferrous and Non ferrous Tooling Materials Carbides, Ceramics and Diamond -Non metallic tool materials-Designing with relation to heat treatment
2. **DESIGN OF CUTTING TOOLS**
   Single Point cutting tools: Milling cutters, Drills, Selection of carbide steels – Determination of shank size for single point carbide tools, Determining the insert thickness for carbide tools, Various heat treatments
3. **DESIGN OF JIGS AND FIXTURES:**
   Basic principles of location and clamping: Locating methods and devices, Jigs-Definition Types, General considerations in the design of Drill jigs, Drill bushing, Methods of Construction. Fixtures-Vice fixtures, Milling, Boring Lathe Grinding fixtures.
4. **DESIGN OF SHEET METAL BLANKING AND PIERCING DIES:**
   Fundamentals of Die cutting operation, Power press types, General press information, Materials Handling equipment. Cutting action in Punch and die operations. Die clearance, Types of Die construction. Die design fundamentals-Banking and piercing die construction, pilots, stripper and pressure pads presswork material, Strip layout, Short run tooling for piercing.
5. **DESIGN OF SHEET METAL BENDING, FORMING AND DRAWING DIES:**
   Bending dies, Drawing dies, Forming dies, Drawing operations, Variables that effect metal flow during drawing. Determination of blank size, Drawing force, Single and double action draw dies.
6. **TOOL DESIGN FOR CNC MACHINE TOOLS**
   Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools- Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine.

Reference Books:

1. Cyrll Donaldson, George H. LeCain, V.C. Goold, "Tool Design", Tata McGraw Hill Publishing Company Ltd., 2000.
2. E.G.Hoffman," Jig and Fixture Design", Thomson Asia Pvt Ltd, Singapore, 2004
3. Prakash Hiralal Joshi, "Tooling data", Wheeler Publishing, 2000
4. Venkataraman K., "Design of Jigs, Fixtures and Presstools", TMH, 2005
5. Haslehurst M., "Manufacturing Technology", The ELBS, 1978
6. Joshi, Prakash Hiralal, "Tooling data", Wheeler Publishing, 2000
7. Sharma, P.C., "Machine Tool and Tool Design ", S Chand Company. 2004.
8. Mehta N.K., "Machine Tool Design", Tata McGraw Hill, 1989.

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: TRIBOLOGY IN DESIGN (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
3	0	2	60	40	25	25	150

SYLLABUS

1. **INTRODUCTION:**
   Introduction to tribology, Introduction to bearings, properties of lubricants, viscosity index, effect of pressure and temperature on viscosity.
2. **SURFACES, FRICTION AND WEAR:**
   Topography of surfaces, Surface features, Surface interaction, Laws of friction, Theory of Friction, Types of friction, Friction properties of metallic and non-metallic materials, effects of friction, COF, friction reducing measures, Wear, causes of wear, types of wear, wear of different materials, effect of wear, steps of wear prevention.
3. **LUBRICATION AND LUBRICANTS:**
   Importance of lubrication, Lubrication principles, boundary lubrication, mixed lubrication, hydrodynamic lubrication, hydrostatic lubrication, Elastohydrodynamic lubrication, Types & Properties of Lubricants, SAE classification.
4. **DESIGN AND ANALYSIS OF FLUID FILM BEARINGS:**
   Introduction, Petroff's equation, Reynold's equation, mechanism of pressure development, plane-slider bearing, idealized journal bearing, step bearing, analysis of finite bearing, lubricant flow through a bearing, heat generation and lubricant temperature, design of journal bearing, design of hydrostatic bearings.
5. **BEARING MATERIALS:**
   Introduction, general requirements,different types of materials
6. **ROLLING ELEMENT BEARINGS:**
   Geometry and kinematics, Contact stresses, Hertzian stress equation, Stresses and deflection, load capacity, Bearing life capacity and variable loads, prediction of fatigue life of a ball bearings, Lubrication.
7. **TRIBO MEASUREMENTS:**
   Surface Topography measurements, Electron microscope and friction and wear measurements, Bearings performance measurements, Bearing vibration measurement.

TERM WORK:

Term work shall be based on the above topics.

Reference Books:

1. Cameron A., "Basic Lubrication Theory", Ellis Horwood Ltd., UK, 1981
2. Fundametal of fluid film lubrication by Hamrock,Schmid,Jacobson
3. Tribology in industries by Sushil Kumar Srinvastava, .Chand & Company Ltd.,2011.
4. Tribology by H.G.phakatkar and R.R. Ghorpade, Nirali Prakashan.
5. Halling J. (Editor), "Principles of Tribology ", Macmillian, 1984.
6. Williams J.A., "Engineering Tribology", Oxford Univ. Press, 1994.
7. Neale, M.J., "Tribology Hand Book", Butterworth Heinemann, 1995.
8. Stolarski T.A., "Tribology in Machine Design", Industrial Press , 1990.
9. Introduction to tribology of bearings by Majumdar,B.C., S.Chand & Company Ltd.,2010.
10. Fundamental of tribology by Basu, Sengupta and Ahuja, PHI Learning pvt.ltd.,2012.

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: ARTIFICIAL INTELLIGENCE (ELECTIVE)
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
4	0	2	60	40	25	25	150

SYLLABUS

1. **Concept of A.I**.:
   Approaches, Foundations of A.I.,
   Problem Formulation: Problem solving agents, Components of problem definition, defining the problem as state space approach, Problem characteristics, Production
   System, searching for solutions, Forward and backward reasoning, means end analysis, Graphs and trees, measuring problem solving performance
   Search Strategies: a)Uninformed (blind) search- breadth first, depth first, and their variations, avoiding repeated states; b) Informed (heuristic) search- heuristic function, Generate and test, Best first search, A* search, Local search algorithms- Hill climbing, Simulated annealing, Branch and bound and Local beam search.
2. **AI Programming Languages:**
   Basic of LISP, Numbers ,Lists ,Arithmetic , Strings and Characters ,Symbols ,Packages, Defining New Functions, Conditional Expressions, Recursion, Input/Output, Assignment, Iteration, Structures and The Type System, Arrays, Hash Tables, And Property Lists, Macros.
3. **Artificial neural networks : Fundamentals and models**
   Introduction, or how the brain works The neuron as a simple computing element, The perceptron, Multilayer neural networks, Accelerated learning in multilayer ,neural networks, The Hopfield network, Bidirectional associative memory, Self-organising neural networks.
4. **Fuzzy Systems.**
   Introduction, Fundamentals of Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy rules, Fuzzy Control. Fuzzy Modeling and applications
   Hybrid Systems: Neuro-fuzzy systems, ANFIS: Adaptive Neuro-Fuzzy Inference System
5. **Genetic Algorithm**
   Introduction, Computer implementation of Genetic algorithm, Data Structures, Reproduction, Cross over and Mutation. Time to reproduce and time to Cross Mapping objective function to fitness, form, Fitness scaling. Applications of genetic algorithm.
6. **A.I. in Robotics:**
   State space search, path selection, AND-OR graphs, means end analysis in a robotic problem, robot problem solving as a production system, robot learning and task planning, symbolic spatial relationship, obstacle avoidance, graph planning.

Reference Books:

1. Introduction to Artificial intelligence By Eugene Charniak, Drew McDermott Addison Wesley
2. Artificial Neural Networks- B.Yegnanarayana, PHI, 1999.
3. Genetic Algorithms in search, Optimization & Machine Learning by David E Goldberg- Addison wesley
4. Artificial Intelligence, Elaine Rich, Kevin Knight, S. Nair, McGraw Hill Publishing Company Ltd
5. Artificial Intelligence- A new synthesis. N.J. Nilsson, Morgan kaufmann Publishers Inc., 1998.
6. Artificial Intelligence and Design of Expert Systems – C.F. Luger & W.A. Stubblefeild, Addison-Wesley.
7. Introduction to Artificial Neural Systems – Jacek M. Zurada, Jaico Publishing House, 2001.
8. Neural Network – Simson Haykin, Macmillan Publication, 1994.
9. Fuzzy Set Theory & its Applications – H.J.Zimmermann, Allied Publishers Ltd, 1996.
10. Stuart Russel, Peter Norwig (2003), "Artificial Intelligence : A Modern Approach" 2/e, (Pearson Education)
11. Dan W. Patterson (1999), "Introduction to Artificial Intelligence and Expert Systems" (7th Indian Reprint) (EEE) (Prentice Hall of India)
12. Groover, Weiss, Nagel, Audrey, "Industrial Robotics- Technology, Programming and Applications"", (McGraw Hill)
13. Fu, Gonzalea and Lee, "Robotics: Control, Sensing, Vision and Intelligence", (McGraw Hill)
14. Shapiro, Stuart Charles, ''Common LISP: an interactive approach'', Computer Science Press, An imprint of W. H. Freeman and Company
15. David S. Touretzky ''COMMON LISP: A Gentle Introduction to Symbolic Computation'', The Benjamin/Cummings Publishing Company,Inc.

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M.TECH. SEMESTER – II (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: SEMINAR-II
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
0	1	0	0	0	0	50	50

The students are required to prepare/present seminar on given topic.
The students will undertake Seminar work for the period of full semester. They may opt for design/develop & fabricate small innovative product.
They are supposed to prepare and submit a seminar report as a part of their term work and give presentation on their work. The faculty should monitor the students for their seminar work regularly every week. They are to be examined based on viva and/or demonstration.

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M.TECH. SEMESTER – III (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: DISSERTATION PRELEMINARIES
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
0	0	16	0	0	225	125	350

The students are required to prepare term project on given topic by industry.

The students will undertake project work for the period of full semester. They may opt for design/develop & fabricate small innovative product. They are supposed to prepare and submit a project report as a part of their term work and give presentation on their work. The faculty should monitor the students for their project work regularly every week. They are to be examined based on viva and/or demonstration.

Dharmsinh Desai University
Faculty of Technology
Department of Mechanical Engineering

M.TECH. SEMESTER – III (ODD/ FIRST TERM OF THE YEAR)
SUBJECT: SEMINAR-III
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
0	0	4	0	0	0	50	50

The students are required to prepare/present seminar on given topic.
The students will undertake Seminar work for the period of full semester. They may opt for design/develop & fabricate small innovative product.

They are supposed to prepare and submit a seminar report as a part of their term work and give presentation on their work. The faculty should monitor the students for their seminar work regularly every week. They are to be examined based on viva and/or demonstration.

Dharmsinh Desai University
Faculty of Technology
Department of Mechanical Engineering

M.TECH. SEMESTER – IV (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: DISSERTATION
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
0	0	24	0	0	300	150	450

The students are required to prepare term project on given topic by industry.
The students will undertake project work for the period of full semester. They may opt for design/develop & fabricate small innovative product. They are supposed to prepare and submit a project report as a part of their term work and give presentation on their work. The faculty should monitor the students for their project work regularly every week. They are to be examined based on viva and/or demonstration.

Dharmsinh Desai University
Faculty of Technology
Department of Mechanical Engineering

M.TECH. SEMESTER – IV (EVEN/ SECOND TERM OF THE YEAR)
SUBJECT: SEMINAR-IV
W.E.F.: 2016-17

Teaching Scheme(Hours/Week)			Examination Scheme (Marks)				
Lectures	Tutorial	Practical	Theory (3 hrs)	Sessional (1 hr)	Practical	T.W.	Total
0	0	4	0	0	0	50	50

The students are required to prepare/present seminar on given topic.
The students will undertake Seminar work for the period of full semester. They may opt for design/develop & fabricate small innovative product.
They are supposed to prepare and submit a seminar report as a part of their term work and give presentation on their work. The faculty should monitor the students for their seminar work regularly every week. They are to be examined based on viva and/or demonstration.

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
TIME TABLE FOR M.TECH. (CAD/CAM) SEMESTER - I (2016)

	8.30 - 9.30	9.30-10-30		10.45-11.45	11.45-12.45		1.30-2.30	2.30-3.30
Monday	AMD	CAPM		SEMINAR	ELECTIVE -I		AMMT	CAPM
	(RMJ)	(JMR)			(SRS)		(PVD)	(EF)
Tuesday	AMD	AMD		ELECTIVE -I	CAD		**CAD LAB**	
	(NAV)	(RMJ)		(SR)	(DSP)		**(RVS)**	
Wednesday	CAD	CAPM		AMMT	ELECTIVE -I		**AMD LAB**	
	(RVS)	(SR)		(EF)	(SRS)		**(NAV)**	
Thursday	**ELECTIVE -I LAB**			CAD	ELECTIVE -I		AMD	**LIBRARY**
	(ASP)			(HNP)	(SR)		(AB)	
Friday	**CAD LAB**			AMMT	CAPM		AMMT	**LIBRARY**
	(HNP)			(PVD)	(EF)		(RVS)	
Saturday								

R E C E S S | **R E C E S S**

Prof. G. D. Bassan

Head, Mech. Engg. Dept.