Dr. Mahalingam College of Engineering and Technology

(An Autonomous Institution)

Pollachi - 642003

Curriculum and Syllabus for

M.E. CAD/CAM

Revision 0

REGULATIONS 2014

DR MAHALINGAM

MCET

COLLEGE OF ENGINEERING AND TECHNOLOGY

Enlightening Technical Minds

Programme : M.E. – CAD/CAM
Curriculum and Syllabus – Revision 0
Approved by Academic Council

Action	Responsibility	Signature of Authorized Signatory
Designed and Developed by	BoS CAD/CAM	
Compiled by	Office of COE	
Approved by	Principal	

Department of Mechanical Engineering

Curriculum for M.E. CAD/CAM

Regulations 2014 - Revision 0

Semester I

Course Code	Course Title	Hours / Week			Credits	Marks
		L	T	P		
THEORY						
140CC0101	Advanced Mathematics	3	1	0	4	100
140CC0102	Computer Applications in Design	3	0	0	3	100
140CC0103	Mechanical Vibrations	3	1	0	4	100
140CC0104	CNC Machines and Robotics	3	0	0	3	100
140CC0105	Modeling and Analysis of Manufacturing Systems	3	0	0	3	100
xxx	Elective-I	3	0	0	3	100
PRACTICAL						
140CC0107	CAM Laboratory	0	0	3	2	100
TOTAL		**18**	**2**	**3**	**22**	**700**

SEMESTER II

Course Code	Course Title	Hours / Week			Credits	Marks
		L	T	P		
THEORY						
140CC0201	Finite Element Analysis	3	0	0	3	100
140CC0202	Micro Electro Mechanical Systems	3	0	0	3	100
140CC0203	Integrated Product and Processes Development	3	0	0	3	100
140CC0204	Design for Manufacture ,Assembly and Environment	3	0	0	3	100
xxx	Elective-II	3	0	0	3	100
xxx	Elective-III	3	0	0	3	100
PRACTICAL						
140CC0207	CAD and CAE laboratory	0	0	3	2	100
TOTAL		**18**	**0**	**3**	**20**	**700**

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SEMESTER III

Course Code	Course Title	Hours / Week			Credits	Marks
		L	T	P		
THEORY						
xxx	Elective-IV	3	0	0	3	100
xxx	Elective-V	3	0	0	3	100
xxx	Elective-VI	3	0	0	3	100
PRACTICAL						
140CC0307	Project Work Phase-I	0	0	12	6	200
TOTAL		**9**	**0**	**12**	**15**	**500**

SEMESTER IV

Course Code	Course Title	Hours / Week			Credits	Marks
		L	T	P		
PRACTICAL						
140CC0407	Project Work Phase-II	0	0	24	12	400
TOTAL		**0**	**0**	**24**	**12**	**400**

Total Credits: 69

LIST OF ELECTIVES

Course Code	Course Title	Hours / Week			Credits	Marks
		L	T	P		
140CC9111	Industrial Robotics and Expert Systems	3	0	0	3	100
140CC9112	Mechatronics System Design	3	0	0	3	100
140CC9113	Advanced Tool Design	3	0	0	3	100
140CC9114	Productivity Management and Re-Engineering	3	0	0	3	100
140CC9115	Applied Materials Engineering	3	0	0	3	100
140CC9116	Computer Aided Process Planning	3	0	0	3	100
140CC9117	Metrology and Non Destructive Testing	3	0	0	3	100
140CC9118	Data Communication in CAD/CAM	3	0	0	3	100
140CC9119	Computational Fluid Dynamics	3	0	0	3	100
140CC9120	Modeling of Dynamic System	3	0	0	3	100
140CC9121	Design of Automotive Systems	3	0	0	3	100
140CC9122	Design and Analysis of Thermal Systems	3	0	0	3	100
140CC9123	Design of Plastic Parts	3	0	0	3	100
140CC9124	Enterprise Resource Planning	3	0	0	3	100
140CC9125	Advanced Mechanisms Design and Simulation	3	0	0	3	100
140CC9126	Flexible Competitive Manufacturing System	3	0	0	3	100
140CC9127	Optimization Techniques in Design	3	0	0	3	100
140CC9128	Tribology in Design	3	0	0	3	100
140CC9129	Advanced Strength of Materials	3	0	0	3	100
140CC9130	Design of Material Handling Equipment	3	0	0	3	100
140CC9131	Mechanics of Composite Materials	3	0	0	3	100
140CC9132	Design of Hydraulic and Pneumatic Systems	3	0	0	3	100
140CC9133	Product Data Management	3	0	0	3	100
140CC9134	Rapid Prototyping and Tooling	3	0	0	3	100
140CC9135	Research Methodology	3	0	0	3	100
140CC9136	Engineering Fracture Mechanics	3	0	0	3	100
140CC9137	Welding Metallurgy	3	0	0	3	100
140CC9138	Combustion and Emission in engines	3	0	0	3	100

BoS Chairman

140CC0101 **ADVANCED MATHEMATICS** **3 1 0 4**

AIM:
To develop analytical capability and to impart knowledge in Mathematical and Numerical methods and their applications in Engineering and Technology and to apply these concepts in engineering problems they would come across

OBJECTIVES:

- At the end of the course, students should be able to understand Mathematical and Numerical methods concepts and apply the concepts in solving the engineering problems.

UNIT I **SIMULTANEOUS EQUATIONS AND NUMERICAL INTEGRATION** **10+3**

Solving of set of equations, Gauss elimination method, Choleski method, Iterative methods, Relaxation method, System of non-linear equations- Newton Raphson method -Newton-Cotes integration formulas, Trapezoidal rule, Simpson's rules, Gaussian quadrature, Adaptive integration, Examples.

UNIT II **BOUNDARY VALUE AND CHARACTERISTIC VALUE PROBLEMS** **8+3**

Shooting method, solution through a set of equations, derivative boundary conditions, Rayleigh-Ritz method, characteristic value problems, solution using Characteristic polynomial method, Jacobi method, Power method and Inverse power method.

UNIT III **CALCULUS OF VARIATIONS** **6+2**

Variation and its properties –Euler's equation – Functionals dependent on first and higher order derivatives - Functionals dependent on functions of several independent variables – Rayleigh Ritz method- Galerkin method.

UNIT IV **PARTIAL DIFFERENTIAL EQUATIONS - NUMERICAL SOLUTION** **7+3**

Laplace's equations, representations as a difference equation, Iterative methods for Laplace's equations, Poisson equation, derivative boundary conditions, irregular and non-rectangular grids, Matrix patterns, Sparseness, ADI method, Applications to heat flow problems.

UNIT V **PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS** **7+2**

Explicit method, Crank-Nicholson method, derivative boundary condition, stability and convergence criteria, Parabolic equations in two or more dimensions, applications to heat flow problems.

UNIT VI **HYPERBOLIC PARTIAL DIFFERENTIAL EQUATION** **7+2**

Solving wave equation by finite differences, stability of numerical method, method of characteristics, Wave equation in two space dimensions, computer programs.

Note: Assignments/Term papers using MATLAB / C / C++ to solve design problems.

L: 45, T: 15, Total: 60

REFERENCES:

1. Curtis F Gerald and Patrick O Wheatley, "Applied Numerical Analysis", Pearson Education, 2002
2. Rajasekaran S, "Numerical Methods in Science and Engineering – A Practical Approach", Wheeler Publishing, 1999, Second Edition.
3. Douglas J Faires and Riched Burden, "Numerical Methods", Brooks/Cole Publishing Company, 1998, Second Edition.
4. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers with Software and Programming Applications", Tata McGraw Hill Edition, 2004
5. John H Mathews and Kurtis D Fink, "Numerical Methods using MATLAB", Prentice Hall, 1998.
6. Ward Cheney and David Kincaid, "Numerical Mathematics and Computing", Brooks/Cole Publishing Company, 1999, Fourth Edition.

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BoS Chairman

140CC0102 COMPUTER APPLICATIONS IN DESIGN 3 0 0 3

AIM:

This programme intends to develop a new breed of Post Graduate Engineers required for the tasks of Design and Development.

OBJECTIVES:

- To give students greater breadth and depth of technical knowledge in the areas of CAD/CAM
- To synthesize and apply the concepts learnt
- To provide experience in team-based engineering design projects
- The emphasis is on mathematical modeling and the application of quantitative techniques associated with design, manufacturing, optimization, probability and statistics to the design and operation of the systems.

UNITI INTRODUCTION TO COMPUTER APPLICATIONS IN NEW PRODUCT DESIGN 9

Concept design – parametric sketching – constraints – computer graphics principles- 2D transformation, scaling, rotation – windowing, view ports – clipping – data exchange formats.

UNIT II COMPUTERS IN DESIGN 10

Solid modeling of Mechanical components – associative features – Sheet metal components, nesting and development – plastic parts with draft and shrinkage allowance – Reverse engineering of components – assembly of parts – tolerance analysis – mass property calculations

UNIT III COMPUTERS IN TOOLING DESIGN 9

Mould design – jigs and fixtures design – check for interferences – mechanism design and analysis – Rapid tooling

UNIT IV COMPUTERS IN DESIGN PRODUCTIVITY 8

Customizing various software by using visual basic, pro/program, script, LISP etc to write applications like design of shafts, gears etc.,

UNIT V MANAGING PRODUCT DESIGN DATA 9

Version control – library creation – catalog making – standardization for design – collaborative design among peer groups – Design optimization for geometry - Design check, approval and validation.

L: 45, T: 0, Total: 45

REFERENCES:

1. William M. Neumann and Robert Sproul " Principles of Computer Graphics" McGraw Hill Book Co. Singapore 1989.
2. Ibrahim Zeid "CAD/CAM – Theory and Practice" – McGraw Hill, International Edition 2010.
3. Rao. P .N. "CAD/CAM :Principles and Applications" Tata McGraw Hill , Second Edition. 2004
4. Schlechtendahl, E. G, CAD – Data transfer for Solid Models, Springer Verlag, Berlin, 1989.
5. Donald Hearn and M Pauline Baker "Computer Graphics" Prentice Hall Inc 1992

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BoS Chairman

140CC0103 **MECHANICAL VIBRATIONS** **3 1 0 4**

AIM:

To develop the theoretical basis and to derive the theories of the mechanical vibrations with sound mathematical principles and to enable students to systematically solve engineering problems regardless of difficulty

OBJECTIVES:

- To learn analytical, experimental, and numerical treatment of single and multi DOF vibration systems. Free and forced vibrations of Mechanical systems with lumped inertia, springs, and dampers are the primary emphasis.

UNIT I **FUNDAMENTALS OF VIBRATION** **8+3**

Introduction – Single degree freedom free vibration systems – Damped vibrations – Single degree freedom forced vibration with elastically coupled viscous dampers, System Identification from frequency response, Support motion, Duhamel's Integral – Impulse Response function – Virtual work – Lagrange's equation— Transient Vibration

UNIT II **TWO DEGREE FREEDOM SYSTEM** **8+3**

Free vibration of spring-coupled system – mass coupled system – Vibration of two degree freedom system – Forced vibration – Vibration Absorber – Vibration isolation.

UNIT III **MULTI-DEGREE FREEDOM SYSTEM** **12+3**

Normal mode of vibration – Flexibility Matrix and Stiffness matrix – Eigen values and eigen vectors – orthogonal properties – Modal matrix-Modal Analysis – Forced Vibration by matrix inversion – Modal damping in forced vibration – Numerical methods for fundamental frequencies.

UNIT IV **VIBRATION OF CONTINUOUS SYSTEMS** **8+3**

Systems governed by wave equations – Vibration of strings – vibration of rods – Euler Equation for Beams – Effect of Rotary inertia and shear deformation – Vibration of plates.

UNIT V **EXPERIMENTAL METHODS IN VIBRATION ANALYSIS** **9+3**

Vibration instruments – Vibration exciters Measuring Devices – Analysis – Vibration Tests – Free and Forced Vibration tests. Examples of Vibration tests – Industrial, case studies.

L: 45, T: 15, Total: 60

REFERENCES:

1. Benson H.Tongue, Principles of Vibration, 2nd edn., Oxford University Press, NY, 2002
2. Thomson, W.T. – "Theory of Vibration with Applications", CBS Publishers and Distributors, New Delhi, 1990.
3. Rao, J.S., & Gupta, K. – "Ind. Course on Theory and Practice Mechanical Vibration", New Age International (P) Ltd., 1984
4. Den Hartog, J.P, "Mechanical Vibrations," Dover Publications, 1990.
5. Rao, S.S.," Mechanical Vibrations,"Pearson Education , 2009

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BoS Chairman

140CC0104 **CNC MACHINES AND ROBOTICS** **3 0 0 3**

AIM:

To study the application of computers in manufacturing section and also to study the components of Industrial robotics and expert systems

OBJECTIVES:

- To introduce the numerical control machine and automation, concept of Industrial robotics,
- To learn the concepts of GI, FMS, AGV's, AS / RS systems, various planning systems and process monitoring, Control systems concepts.
- To learn the basics about robotics and robot manipulation in space, the controlling of Robots and devices system, Sensor technology, Robot programming and expert system.

UNIT I INTRODUCTION AND DESIGN FEATURES OF CNC MACHINES 9

Working principles of typical CNC lathes, turning centre, machining centre, CNC grinders, CNC gear cutting machines, wire cut EDM. Selection of CNC machine tools, structure, drive kinematics, gear box, main drive, selection of timing belts and pulleys, spindle bearings arrangement and installation. Re-circulating ball screws, linear motion guide ways, tool magazines, ATC, APC, chip conveyors tool turrets, pneumatic and hydraulic control system, Open loop and closed loop systems , microprocessor based CNC systems, description of hardware and software interpolation systems, spindle encoder

UNIT II PART PROGRAMMING OF A CNC LATHE 9

Process planning, tooling, preset and qualified tools, typical tools for turning and machining centres. Axes definition, machine and workpiece datum, turret datum, absolute and incremental programming, tape codes, ISO and EIA codes, G and M functions, tool offset information, soft jaws, tool nose radius compensation, long turning cycle, facing cycle, constant cutting velocity, threading cycle, peak drilling cycle, part programming examples.

UNIT III MANUAL PART PROGRAMMING OF A MACHINING CENTRE 9

Co-ordinate systems, cutter diameter compensation, fixed cycles, drilling cycle, tapping cycle, boring cycle, fineboring, back boring cycle, area clearance programs, macro, parametric programming, part programming examples. CAD/CAM based NC programming, features of CAM packages.

UNIT IV FUNDAMENTAL CONCEPT OF ROBOTICS AND ROBOT DRIVES 9

History, present status and future trends, robotics and automation, laws of robotics, robot definition, robotics system and robot anatomy, specification of robots, resolution, repeatability and accuracy of a manipulator. Power transmission systems and control robot drive mechanisms, mechanical transmission method, rotary-to-rotary motion conversion, rotary–to-linear motion conversion end effectors, types, gripping problem, remote-centered compliance devices, control of actuator in robot mechanisms. Sensors for robotic applications.

UNIT V TRANSFORMS AND KINEMATICS 9

Homogeneous co-ordinates, co-ordinate reference frames, homogeneous transformations for the manipulator, the forward and inverse problem of manipulator kinematics, motion generation, manipulator dynamics, robot programming.

L: 45, T: 0, Total: 45

REFERENCES

1. Radhakrishnan .P, "Computer Numerical Control CNC Machines" New central book agency, 1992
2. Richard D Klafter, Thomas A cmielewski, Michael Negin, "Robotc Engineering, AnIntegrated Approach", Eastern economy edition prentice hall Pvt. Ltd., 1989.
3. Mikell .P. Groover, Mitchell weiss, Roger N Nagel G Odrey, "Industrial Robotics", Mc-Graw Hill book co, NY, 1986.
4. Yoram Koren, "Computer Control of Manufacturing Systems", Mc-Graw Hill book co, 1986.
5. Programming instruction manuals of CNC lathes and machining centres, 2001
6. Shuman .Y .Nof, "Handbook of Industrial Robotics", John wiley and sons, New York, 1985

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BoS Chairman

140CC0105 MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS

3 0 0 3

AIM:
To highlight the basic concepts and procedure for Mathematical Modeling and analysis of manufacturing systems

OBJECTIVES:

- To know the fundamentals of automation in material handling
- To understand the types and principles of manufacturing systems
- To learn the basic concepts and components of FMS
- To apply key management interfaces and activities
- To use the various optimized production techniques

UNIT I MANUFACTURING SYSTEMS AND MODELS **10**

Types and principles of manufacturing systems, types and uses of manufacturing models, physical models, mathematical models, model uses, model building.

UNIT II MATERIAL FLOW SYSTEMS **12**

Assembly lines-Reliable serial systems, approaches to line balancing, sequencing mixed models. Transfer lines and general serial systems-paced lines without buffers, unpaced lines. Shop scheduling with many products. Flexible manufacturing systems-system components, planning and control. Group technology-assigning machines to groups, assigning parts to machines. Facility layout-Quadratic assignments problem approach, graphic theoretic approach.

UNIT III SUPPORTING COMPONENTS **7**

Machine setup and operation sequencing-integrated assignment and sequencing. Material handling systems-conveyor analysis, AGV systems. Warehousing-storage and retrieval systems, order picking.

UNIT IV GENERIC MODELING APPROACHES **5**

Analytical queuing models, a single workstation, open networks, closed networks. Empirical simulation models-even models, process models, simulation system, example manufacturing system.

UNIT V SYNCHRONIZATION MANUFACTURING **5**

Synchronization Vs Optimization, defining the structure, identifying the constraint, exploitation, buffer management.

UNIT VI PETRI NETS **6**

Basic definitions-dynamics of Petri nets, transformation methods, event graphs, modeling of manufacturing systems.

L: 45, T: 0, Total: 45

REFERENCES:

1. Ronald G Askin, "Modeling and Analysis of Manufacturing Systems", John Wiley and Sons, Inc, 1993
2. Mengchu Zhou, "Modeling, Simulation, and Control of Flexible Manufacturing Ststems: A Petri Net Approach",Worls Scientific Publishing Company Pvt Ltd. 2000
3. Jean Marie Proth and Xiaolan Xie, "Petri Nets: A Tool for Design and Management of Manufacturing Systems" John Wiley and Sons, New York, 1996
4. Brandimarte. P, Villa. A, "Modeling Manufacturing Systems" Springer Verlag, Berlin, 1999.

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BoS Chairman

140CC0107 **CAM LABORATORY** **0 0 3 2**

AIM:
To equip the students with today's CAM packages

OBJECTIVES:

- To familiarize in part programming and tool path generation algorithms
- To understand the simulation concepts in CAM packages
- To provide students an extensive and intensive training in commercial CAM software

Simulation and Machining using CNC / DNC Machine Tools – Use of FEM Packages - Relational Data Base – Networking – Practice on Computer Aided Measuring Instruments - Image Processing – Software Development for Manufacturing – CNC Controllers – Use of advanced CNC Machining Packages – Business Data Processing.

Total : 45

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BoS Chairman

SEMESTER II

140CC0201 FINITE ELEMENT ANALYSIS 3 0 0 3

AIM:

To study the basic principles and applications of the Finite Element Analysis in product development

OBJECTIVES:

- To introduce Engineering Analysis tool FEA, its application in Linear static Analysis and 2D problems
- To study Finite Element modeling and simulation Techniques
- To use FEA in structural vibration and thermal Analysis
- To study and use Finite Element Software (ANSYS)

UNIT I INTRODUCTION & ONE-DIMENSIONAL PROBLEMS 10

Relevance of finite element analysis in design - Variational principles and methods – Weighted-Integral statements – Weak formulations – Ritz method – Method of weighted residuals – Applications of FEA - Finite element modeling – Co-ordinates and shape functions - Potential energy approach – Galerkin's approach – One dimensional finite element models in Solid mechanics and Heat transfer – Finite element model for beams

UNIT II TWO-DIMENSIONAL PROBLEMS 10

Poisson equation – Laplace equation – Weak form – Element matrices for triangular and rectangular elements – Evaluation of integrals – Assembly – Axi-symmetric problems – Applications – Conduction and convection heat transfer - Torsional cylindrical member – Transient analysis - Theory of elasticity – Plane strain – Plane stress – Axi-symmetric problems – Principle of virtual displacement

UNIT III ISOPARAMETRIC ELEMENTS 8

Introduction – Bilinear quadrilateral elements – Quadratic quadrilaterals – Hexahedral elements - Numerical integration – Gauss quadrature – Static condensation – Load considerations – Stress calculations – Examples of 2D and 3D applications

UNIT IV STRUCTURAL DYNAMICS APPLICATIONS 9

Dynamic equations – Mass and damping matrices – Natural frequencies and modes – Reduction of number of DOF-response history – Model methods – Ritz vectors – Component mode synthesis – Harmonic response – Direct integration techniques – Explicit and implicit methods – Analysis by response spectra – Example problems

UNIT V NON-LINEAR PROBLEMS & ERROR ESTIMATES 8

Introduction – Material non-linearity – Elasto Plasticity – Plasticity – Visco plasticity – Geometric non-linearity – Large displacement – Error norms and convergence rates – H-refinement with adaptivity – adaptive refinement

L: 45, T: 0, Total: 45

REFERENCES:

1. Reddy J.N.,"An Introduction to the Finite Element Method",McGraw Hill, International Edition,2005
2. Logan D.L, "A First Course in the Finite Element Method", Third Edition, Thomson Learning, 2002
3. Cook, Robert Davis et al "Concepts and Applications of Finite Element Analysis", Wiley, John & Sons, 1999.
4. Segerlind L.J., "Applied Finite Element Analysis", John Wiley, 1984
5. Rao. S.S., "Finite Element Analysis", 2002 Edition.
6. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", Fourth Edition, Volumes 1 & 2, McGraw Hill International Edition, Physics Services, 1991
7. Bathe K.J., "Finite Element Procedures in Engineering Analysis", Prentice Hall, 1990.

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BoS Chairman

140CC0202 MICRO ELECTRO MECHANICAL SYSTEMS 3 0 0 3

AIM:
To explore the world of Micro electro mechanical devices and systems ("MEMS").

OBJECTIVES:
- To study about Micro electromechanical devices such as pressure sensors, accelerometers,
- To know about a broad range of disciplines, from micro fabrication to mechanics.

UNIT I INTRODUCTION 9

Overview-Microsystems and microelectronics - Working principle of Microsystems -micro actuation techniques-microsensors-types-microactuators-types-micropump-micromotors-micro-valves-microgrippers-scaling laws-scaling in geometry-scaling in rigid body dynamics- scaling in electrostatic forces- scaling in electricity- scaling in fluid mechanics- scaling in heat transfer.

UNIT II MATERIALS AND FABRICATION PROCESS 9

Substrates and wafer-single crystal silicon wafer formation-ideal substrates-mechanical properties-silicon compounds - Sio_2, SiC, Si_3N_4 and polycrystalline silicon - Silicon piezoresistors - Gallium aresenside, Quartz-piezoelectric crystals-polymers for MEMS -conductive polymers – Photolithography - Ion implantation - Diffusion – Oxidation –CVD - Physical vapor deposition - Deposition by epitaxy - etching process

UNIT III MICROMECHANICS 9

Introduction-static bending of thin plates-circular plates with edge fixed - rectangular plate with all edges fixed and square plate with all edges fixed – Mechanical vibration-resonant vibration- micro accelerometers-design theory and damping coefficients- thermo mechanics-thermal stresses-fracture mechanics-stress intensity factors, fracture toughness and interfacial fracture mechanics.

UNIT IV MICRO SYSTEM MANUFACTURING 9

Clean room technology-Bulk Micro manufacturing- surface micro machining –LIGA-SLIGA-Micro system packaging-materials-die level-device level-system level-packaging techniques-die preparation-surface bonding-wire bonding-sealing

UNIT V MICRO SYSTEM DESIGN 9

Design considerations-process design-mask layout design- mechanical design-applications of micro system in -automotive industry-bio medical –aero space-telecommunications.

L: 45, T: 0, Total: 45

REFERENCES:

1. Mohamed Gad-el-Hak, The MEMS Hand book, CRC press 2002
2. Julian W.Gardner,Vijay K.Varadan,Osama O.Awadel Karim,Microsensors MEMS and Smart Devices, John Wiby & sons Ltd.,2001
3. S.Fatikow,U.Rembold,Microsystem Technology and Microrobotics,Springer-Verlag Berlin Heidelberg ,1997.
4. Tai-Ran Hsu,MEMS & Microsystems Design and Manufacture,Tata McGraw-Hill,2006.
5. Francis E.H Tay and W.O Choong, Microfludics and BioMEMS Applications, Springer, 2002

BoS Chairman

140CC0203 INTEGRATED PRODUCT AND PROCESSES DEVELOPMENT

3 0 0 3

AIM:

To study the various tools and approaches available for product design and development.

OBJECTIVES:

- To give a clear insight about various aspects of product design and development
- To develop a procedural approach for the product design and development

UNIT I INTRODUCTION 9

Characteristics of Successful Product Development-Interdisciplinary activity-Duration and Costs of Product Development- Challenges of Product Development -Development Processes and Organizations-A Generic Development Process-Concept Development: The Front-End Process Adapting the Generic Product Development Process- The AMF Development Process-Product Development Organizations-The AMF Organization

UNIT II PRODUCT PLANNING 9

Product Planning Process- Identifying Opportunities- Evaluating and Prioritizing Projects- Allocating Resources and Timing- Pre-Project Planning-Reflect on the Results and the Process-Identifying Customer Needs- Raw Data from Customers- Interpreting Raw Data in Terms of Customer Needs-Organizing the Needs into a Hierarchy-Establishing the Relative Importance of the Needs-Reflecting on the Results and the Process

UNIT III PRODUCT SPECIFICATIONS **9**

Specifications - Specifications Established - Establishing Target Specifications-Setting the Final Specifications-Concept Generation-The Activity of Concept Generation-Clarify the Problem- Search Externally-Search Internally-Explore Systematically- Reflect on the Results and the Process.

UNIT IV CONCEPT SELECTION **9**

Concept Selection- Overview of Methodology-Concept Screening-Concept Testing-Define the Purpose of the Concept Test- Choose a Survey Population- Choose a Survey Format- Communicate the Concept- Measure Customer Response-Interpret the Results- Reflect on the Results and the Process

UNIT V PRODUCT ARCHITECTURE **9**

Product Architecture-Implications of the Architecture-Establishing the Architecture-Delayed Differentiation-Platform Planning-Related System-Level Design Issues

L: 45, T: 0, Total: 45

REFERENCES:

1. Product Design and Development, Karl T. Ulrich and Steven .D Epinger , McGraw-Hill International Edns. 1999.
2. Kevien Otto and Kristin Wood, "Product Design" Pearson Publication, 2004
3. Tool Design – Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5
4. Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewood, 1992,ISBN, 1-55623-603-4
5. Concurrent Engg. /Integrated Product Development. Kemnneth Crow, DRM Associates, 26/3,Via Olivera, Palos Verdes, CA 90274(310) 377-569,Workshop Book

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BoS Chairman

140CC0204 DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENT

3 0 0 3

AIM:

To study how a design can be made suitable for various manufacturing and assembly process requirements.

OBJECTIVES:

- To study the various factors influencing the manufacturability of components and the use of tolerances in manufacturing.
- To apply this study to various forging, casting, welding and machining processes
- To study about the various assembly methods and processes and design for assembly guidelines

UNIT I INTRODUCTION **8**

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

UNIT II FACTORS INFLUENCING FORM DESIGN **10**

Influence of materials on form design - form design of grey iron, malleable iron, steel and aluminium castings - form design of welded members, forgings.

UNIT III COMPONENT DESIGN - MACHINING CONSIDERATION **9**

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.

UNIT IV COMPONENT DESIGN - CASTING CONSIDERATION **9**

Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores.Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

UNIT V DESIGN FOR THE ENVIRONMENT **9**

Introduction – Environmental OBJECTIVESS: – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

L: 45, T: 0, Total: 45

REFERENCES:

1 Boothroyd, G, Design for Assembly Automation and Product Design, Marcel Dekker, New York., 1992.
2 Bralla, Design for Manufacture handbook, McGraw hill, 1999.
3 Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994
4 Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995
5 Fixel, J. Design for the Environment McGraw hill., 1996.
6 Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub., 1996.
7 Kevien Otto and Kristin Wood, Product Design. Pearson Publication, 2004

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BoS Chairman

140CC0207	CAD AND CAE LABORATORY	0	0	3	2

AIM:
To learn, formulate and solve design problems using state of the art commercial CAD/CAE packages.

OBJECTIVES:

- To equip the students with fundamental theories and technologies in geometric modeling algorithms, curves and surfaces, meshing algorithms,
- To provide students an extensive and intensive practice of a leading commercial CAD/CAE software with ample in-depth projects

UNIT I CAD (COMPUTER AIDED DRAFTING)
Modeling and Assembly of mechanical components using parametric and feature based packages. Introduction to CAD software, Part – Assembly –Drafting model of mechanical machine components like –Flange coupling, Universal coupling, Screw jack etc.

View: Orthographic view, Isometric view, Sectional view, Exploded view.

GD&T: Standard, Part list, Bill of Material, Machining symbols, Tolerance – Fits and Geometric.

UNIT II CAE (COMPUTER AIDED ENGINEERING)
Analysis of mechanical machine components using analysis software.
Introduction of CAE software, STRUCTURAL Analysis: Static analysis -2D, 3D, Beam, Truss. THERMAL Analysis: 2D Conduction, 3D Convection. DYNAMICS Analysis: Modal analysis, Transient analysis.

Total: 45

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BoS Chairman