ACADEMIC REGULATIONS
PROGRAM STRUCTURE
and
DETAILED SYLLABUS

Master of Technology
Design for Manufacturing - DMF

(Two Year Regular Programme)
(Applicable for the Batches admitted from 2014)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

Gokaraju Rangaraju
Institute of Engineering and Technology, Hyderabad
M. Tech. GR14 Regulations

Gokaraju Rangaraju Institute of Engineering & Technology 2014 Regulations (GR14 Regulations) are given hereunder. These regulations govern the programmes offered by the Department of Mechanical Engineering with effect from the students admitted to the programmes in 2014-15 academic year.

1. **Programme Offered:** The programme offered by the Department is M.Tech in Design for Manufacturing, a two-year regular programme.

2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

3. **Admissions:** Admission to the M.Tech in Design for Manufacturing Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the Institute/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in PGECET conducted by the APSCHE for M. Tech Programmes or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

4. **Programme Pattern:**
   a) Each Academic year of study is divided into two semesters.
   b) Minimum number of instruction days in each semester is 90.
   c) The total credits for the Programme is 88.
   d) All the registered credits will be considered for the calculation of the final percentage of marks.

5. **Award of M.Tech Degree:** A student will be declared eligible for the award of the M. Tech Degree if he/she fulfills the following academic requirements:
   a) A student shall be declared eligible for the award of M.Tech degree, if he/she pursues the course of study and completes it successfully in not less than two academic years and not more than four academic years.
   b) A Student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the date of admission, shall forfeit his/her seat in M.Tech course.
   c) The Degree of M.Tech in Design for Manufacturing shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the requirements for the award of the degree.

6. Attendance Requirements

a) A student shall be eligible to appear for the end semester examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted. A committee headed by Dean (Academic Affairs) shall be the deciding authority for granting the condonation.

c) Students who have been granted condonation shall pay a fee as decided by the Academic Council.

d) A candidate shall get minimum required attendance at least in three (3) theory subjects in the semester to get promoted to the next semester. In order to qualify for the award of M.Tech Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

e) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. They may seek re-registration for that semester when offered next with the academic regulations of the batch into which he/she gets re-registered.

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment

a) Paper setting and Evaluation of the Answer Scripts shall be done as per the procedures laid down by the Academic Council of the College from time to time.

b) The following is the division of marks between internal and external evaluations.

Particulars	Internal	External	Total
Theory	40	60	100
Practical	40	60	100
Comprehensive Viva	--	100	100
Seminar	50	----	50
Project Work	Grade	-----	----
Project work & dissertation (Grading System)	------	Grade	----

c) Continuous Internal Evaluation and Semester End Examinations

The assessment of the student's performance in each course will be based on continuous internal evaluation and semester-end examinations. The marks for each of the component of assessment are fixed as shown in the following Table.

Assessment Procedure

S.No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	40	Internal Exams & Continuous Evaluation	1. Mid-examinations: … 30 Marks (Two mid-semester examinations shall be conducted for 30 marks each for duration of 2 hours. Average of the two mid semester examinations shall be considered) 2. Tutorial: … … 5 Marks 3. Attendance: .. 5 Marks
		60	Semester-end examination	The semester-end examination is for a duration of 3 hours
2	Practical	40	Internal Exams & Continuous Evaluation	1) Lab Internal :15 marks 2) Record : 5 marks 3) Continuous Assessment : 15 marks 4) Attendance : 5 marks
		60	Semester-end examination	The semester-end examination is for a duration of 3 hours.

d) Comprehensive Viva: There shall be a Comprehensive Viva-Voce in II year I semester. The Comprehensive Viva-Voce will be conducted by the committee consisting of Head of the Department and two senior faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the student's understanding in various subjects he/she studies during the M.Tech course of study. The Comprehensive Viva-Voce is valued for 100 marks by the committee. There are no internal marks for the Comprehensive Viva-voce.

e) Seminar: There shall be three Seminar Presentations by the student, one each in the I,II and III semesters. For the seminar, the student shall collect the information on a specialized topic other than his/her project and prepare a technical report, showing his understanding over the topic, and

submit to the department, which shall be evaluated by a Departmental committee consisting of the Head of the department, seminar Supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

f) Project: The work on the project shall be initiated in the beginning of the second year and the duration of the project is for two semesters (III & IV). Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the Project Review Committee (PRC).
   i) PRC shall be constituted with HOD as chair person, two senior faculty members and project supervisor.
   ii) Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).
   iii) A candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the PRC for its approval. Only after obtaining the approval of PRC the student can initiate the Project work.
   iv) If a candidate wishes to change his supervisor or topic of the project he/she can do so with approval of PRC. However, the PRC shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the project work starts from the date of change of supervisor or topic as the case may be.
   v) Project Work: The candidate should be continuously observed by the project supervisor. His performance is assessed by the PRC through a seminar and interim report. Full credits are awarded 'SAT' on satisfactory performance of the student. 'US' grade is given on unsatisfactory performance. If the performance is unsatisfactory, the PRC should redefined the project and the candidate is allowed to appear for the evaluation only after six months.
   vi) Project Work & Dissertation: A candidate shall submit status report (in a bound-form) in two stages at least with a gap of 3 months between them to the project supervisor.
   vii) A candidate is permitted to submit Project dissertation only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of dissertation to the Head of the Department and shall make an oral presentation before the PRC along with project supervisor.
   viii) Student has to submit to the department three copies of the Project dissertation along with a soft copy on CD certified by the supervisor.

ix) The dissertation shall be adjudicated by one examiner selected by the Controller of examination from the panel of 3 examiners as suggested by Head of the Department, who are eminent in that field with the help of the concerned guide and head of the department.

x) If the report of the Examiner is not favorable, the candidate shall revise and resubmit the dissertation, in the time frame as described by PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

xi) If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the Department and the examiner who adjudicated the dissertation. The Board shall jointly report candidates work as:

A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory.

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination.

If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he/she fails to get a satisfactory report at the second viva-voce examination, he/she will not be eligible for the award of the degree.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for re-counting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. **Academic Requirements:**

a) A student shall be deemed to have secured the minimum academic requirements in a subject if he / she secures a minimum of 40% of marks in the Semester-end Examination and a minimum aggregate of 50% of the total marks in the Semester-end examination and Internal Evaluation taken together.

b) In order to qualify for the award of M.Tech Degree, the student shall complete the academic requirements of passing in all the Courses per the course structure including Seminars and Project if any.

c) In case a Student does not secure the minimum academic requirements in any course, he/she has to reappear for the Semester-end Examination in the course, or re-register for the same course when next offered or re-register for any other specified course, as may be required. However, one more additional chance may be provided for each student, for improving the internal marks provided the internal marks secured by a student are less than 50% and he/she failed finally in the course concerned. In the event of taking another chance for re-registration, both the internal and external marks obtained in the previous attempt are nullified. In case of re-registration, the student has to pay the re-registration fee for each course, when next offered.

13. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of M. Tech Degree by JNTUH, he/she shall be placed in one of the following three classes:

Class Awarded	% of Marks Secured
First Class with Distinction	Marks ≥ 70%
First Class	60% ≤ Marks < 70%
Second Class	50% ≤ Marks < 60%

14. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against him, the result of the student (for that Semester) may be withheld and he/she will not be allowed to go into the next Semester. The award or issue of the Degree may also be withheld in such cases.

15. **Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities:** Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

16. **Transitory Regulations:** Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the Degree Programme, may be considered eligible for re-registration to the same or equivalent subjects as and when they are offered.

17. General Rules

a) The academic regulations should be read as a whole for the purpose of any interpretation.
b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.
d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute/ University.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
M.Tech (Design for Manufacturing)

DMF - M.Tech - I Year, I Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
PC	GR14D5109	Advanced Mechanics of Solids	3	40	60	100
PC	GR14D5110	Materials Technology	3	40	60	100
PC	GR14D5111	Precision Engineering	3	40	60	100
PC	GR14D5112	Design for Manufacturing and Assembly	3	40	60	100
		Elective I	3	40	60	100
PE	GR14D5113	Special Manufacturing Processes				
	GR14D5114	Finite Element Applications in Manufacturing				
	GR14D5115	Quality Engineering in Manufacturing				
		Elective II	3	40	60	100
PE	GR14D5116	Advanced CAD				
	GR14D5117	Mechatronics				
	GR14D5118	Theory of Elasticity & Plasticity				
PC	GR14D5119	Manufacturing Simulation & Precision Engineering Lab	2	40	60	100
SPW	GR14D5175	Seminar-I	2	50	—	50
		Total	**22**	**330**	**420**	**750**

DMF - M.Tech- I Year, II Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
PC	GR14D5120	Design of Hydraulics and Pneumatics Systems	3	40	60	100
PC	GR14D5121	Total Quality Management	3	40	60	100
PC	GR14D5122	Computer Aided Manufacturing	3	40	60	100
PC	GR14D5123	Design and Manufacturing of MEMS and Micro Systems	3	40	60	100
		Elective III	3	40	60	100
PE	GR14D5124	Industrial Robotics				
	GR14D5125	Tool Design				
	GR14D5126	Production and Operations Management				
		Elective IV	3	40	60	100
PE	GR14D5127	Performance modeling and Analysis of Manufacturing Systems				
	GR14D5128	Computational Fluid Dynamics				
	GR14D5129	Automation in Manufacturing				
LAB	GR14D5130	CAD/CAM Lab	2	40	60	100
SPW	GR14D5176	Seminar-II	2	50	—	50
		Total	**22**	**330**	**420**	**750**

CSE - M.Tech - II Year, I Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
SPW	GR14D5178	Comprehensive Viva	2	—	100	100
SPW	GR14D5177	Seminar-III	2	50	—	50
SPW	GR14D5179	Project work	18	Grade		
		Total	**22**	**50**	**100**	**150**

CSE - M.Tech - II Year, II Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
SPW	GR14D5180	Project work and Dissertation	22	Grade		

I-Year

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED MECHANICS OF SOLIDS

Course Code: GR14D5109 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- To solve advanced solid mechanics problems using classical methods.
- To apply commercial software on select, applied solid mechanics problems.

Outcomes

- To analyze solid mechanics problems using classical methods and energy methods
- To apply various failure criteria for general stress states at points.
- To develop a basic understanding and ability to use ANSYS for the modeling and solution of beam, frame, and shell structures

Unit-I

Shear center: Bending axis and shear center, shear center for axis-symmetric and unsymmetrical sections

Unsymmetrical bending: Bending stresses in beams subjected to nonsymmetrical bending, deflection of straight beams due to nonsymmetrical bending.

Unit-II

Curved beam theory: Winkler Bach formula for circumferential stress, limitations, correction factors, radial stress in curved beams, closed ring subjected to concentrated and uniform loads-stresses in chain links.

Unit-III

Torsion: Linear elastic solution; prandtal elastic membrane (Soap-Film) analogy; narrow rectangular cross section; hollow thin wall torsion members ,multiply connected cross section.

Unit-IV

Theory of plates: Introduction; stress resultants in a flat plate; kinematics: strain-displacement relations for plates; equilibrium equations for small displacement theory of flat plates; stress-strain-temperature relation for isotropic plates: strain energy of a plate; boundary conditions for plate;

Two Dimensional Elasticity Problems: in polar co-ordinators, general equations in polar coordinates, stress distribution symmetrical about an axis,

pure bending of curved bars, displacements for symmetrical stress distributions, rotating discs.

Unit-V

Beams on Elastic Foundation: General theory, infinite beam subjected to concentrated load, boundary conditions, infinite beam subjected to a distributed load segment, semi-infinite beam with concentrated load near its end, short beams.

Contact stresses: Introduction, problem of determining contact stresses, assumptions on which a solution for contact stresses is based, expressions for principal stresses, method of computing contact stresses, deflection of bodies in point contact, stresses for two bodies in contact over narrow rectangular area (Line contact), loads normal to area, stresses for two bodies in line contact, normal and tangent to contact area.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing Power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Books

1. Advanced Mechanics of materials by Boresi & Sidebottom-Wiely International.
2. Theory of elasticity by Timoschenko S.P. and Goodier J.N. McGraw-Hill Publishers

Reference Books

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of plates , Timoshenko.
3. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MATERIALS TECHNOLOGY

Course Code: GR14D5110 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- To study the elastic, plastic and fracture behavior of engineering materials.
- To study the various modern materials, properties and their applications.
- To understand the selection of metallic and non-metallic materials for various engineering Applications.

Outcomes

- Students gain knowledge of advanced materials and will be able to select the right material for Various engineering applications.

Unit-I

Elastic and Plastic Behaviour: Elasticity in metals and polymers, mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening.

Unit-II

Poly phase, mixture, precipitation, particle, fiber and dispersion strengthening, effect of temperature, strain and strain rate on plastic, behavior, super plasticity, deformation of non crystalline material.

Unit-III

Fracture Behaviour: Griffith's Theory, stress intensity, factor and fracture toughness, Toughening Mechanisms, Ductile and Brittle transition in steel, High Temperature Fracture, Creep, Larson, Miller parameter, Deformation and Fracture mechanism maps. Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and Paris Law, Effect of surface and metallurgical parameters on Fatigue analysis, Sources of failure, procedure of failure analysis.

Unit-IV

Material Selection: Motivation for selection, cost basis and service requirements, selection for mechanical properties, strength, toughness, fatigue and creep. Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing, Case studies in

Materials Selection with relevance to Aero, auto, Marine, Machinery and Nuclear applications.

Unit- V

Modern Metallic Materials: Dual Phase Steels , Micro alloyed, High Strength, Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP) Steel, Maraging Steel, Intermetallic, Ni and Ti Aluminides, Smart Materials, Shape Memory alloys, Metallic Glass Quasi Crystal and Nano Crystalline Materials. Fibres, Foames, Adhesives and coatings, Advanced structural ceramics: WC, Tic, Tac, Al2O3, Si3N4, CBN, Diamond Properties, processing and applications.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing Power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Books

1. Mechanical Metallurgy George E Dieter
2. Selection and use of engineering materials Charles JA, Butter worth, Heir maker

Reference Books

1. Mechanical behavior of materials
2. Thomas H Courtney 2nd Edu McGraw-Hill 2000.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRECISION ENGINEERING

Course Code: GR14D5111 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- To study the concepts of accuracy, geometric dimensioning, tolerance and Datum's
- To study the various Nano Technology and Electrochemical atomic bit processing.
- To understand the working of surface-mechanical optical measuring systems and working systems of CMM

Outcomes

- Students gain knowledge of application of tolerances, representation and analysis of surface finish
- Students gain knowledge of application nanotechnology for attaining accuracy.

Unit-I

Concepts of Accuracy: Introduction: Types of errors and tolerances. Concepts of accuracy MFTW (Machine, Fixture, Tool, Work) System, IS919-1993 Limits and Fits, Spindle inaccuracies, Thermal effects on accuracies, Accuracy of Numerical control system, Errors due to Numerical Interpolation. Displacement Measurement System and velocity Lags.

Unit-II

Geometric Dimensioning and Tolerancing: Representation of Geometric dimensioning and tolerances, MMC, LMC and RFS, Tolerance Zone conversions, Effect of positional tolerances and its representation, Computation of transnational and rotational accuracy, geometric analysis and application.
UNIT III: DATUMS: Six degree of freedom, Datum point, Datum line and Datum Plane, Three mutually perpendicular planes, 3-2-1 principle of location, 4-1-1 and V' block location.
Cylindrical and Diamond pin location, Grouped datum system with Spigot and Recess pair, equalizing datum. Datum oddly configured. ANALYSIS OF SURFACE FINISH: Importance of Surface finish, Representation and analysis of Surface finish, Relationship between attainable tolerance grades and different machining process, Cumulative affect of tolerances and sure fit law, normal law and truncated normal law.

Unit-IV

Tolerance Analysis: Process capability, Mean, Median, Mode Variance Skewness, Kurtosis, 6sigma, Cp, Cpk, Cost aspects, Application of 6sigma limits to inaccuracies and performance analysation.

TOLERANCE CHARTING TECHNIQUES: Operation sequence for typical shaft type components, preparation of process drawings for different operations, tolerance work sheets and centrally analysis, Examples, Design features to facilitate machining, Datum featured, functional and manufacturing. Components design-Machining considerations, redesign for manufacturing, Examples.

Unit-V

Fundamentals of Nano Technology: System of Nanometer accuracies-mechanism of metal processing-Nano Physical processing of Atomic bit units.Nano Technology and Electrochemical atomic bit processing.

MEASURING SYSTEM PROCESSING: In processing or In-Situ measurement of position of processing point-post process and on machine measurement of dimensional features and surface-mechanical and optical measuring systems. Working systems of CMM. Laser alignment and testing.

Teaching Methodology

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3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things

Text Books

1. Precision Engineering in manufacturing / Murthy.R.L / New Age International (P) limited, 1996
2. Geometric Dimensioning and Tolerancing / James D.meadows / Marcel Deckker inc.1995
3. Mechatronics by HMT

Reference Books

1. Nano Technology /Norio Taniguchi / Oxford University press 1996
2. Engineering design- Asystematic Approach / Matousek / Blackie & Son ltd.London.
3. Industrial management by RK.JAIN

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN FOR MANUFACTURING AND TECHNOLOGY

Course Code: GR14D5112 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- Understand modern manufacturing operations their capabilities, limitations and how to design for lowest cost.
- Gain insight into how designers influence manufacturing schedule and cost.
- Learn how to analyze products and be able to improve their manufacturability and lower costs.
- Understand the relationship between customer desires, functional requirements, product materials, product design, and manufacturing process selection.

Outcomes: Upon completion of this course, students will be able to:

- Understand constraints of manufacturing processes that limit design possibilities withrespect to cycle time, material handling, and other factory costs.
- Apply quantitative methods to assess DFA between different designs.
- Apply principles of DFA to increase manufacturing efficiency in assembly processes.
- Distinguish poor practices from robust design practices for discussed processes. Prepare project or report to illustrate applied DFM principles per an example from industry.

Unit-I

Introduction: Engineering Design Process, Considerations of a good design, Description of design process, Creativity in Design, Creative thinking methods, Materials: Relation of Material selection to design and process, Process selection.

Unit-II

Design for Manufacturing: DFM guidelines and specific design rules, Machining Process: Overview of various machining processes- general design rules for machining, Dimensional tolerance and surface roughness. Material Casting: Appraisal of various casting processes, Design guidelines for casting , Use of solidification simulation in casting design, chart. Performance characteristics, material selection process and economics of materials. Design of Forgings: DFM guidelines for closed - die forging, parting lines of die drop forging die design.

Unit-III

Metal Joining: Appraisal of various processes, Factor in the design of weldments, General design guidelines, Pre and post treatment of welds, Effect of thermal stresses in weld joints, design for brazed joints. Sheet metal forming: Stamping, Bending, Stretching and deep drawing, General design guide lines, Keeler, Goodman forming line diagram.

Unit-IV

Assemble Advantages: Development of assemble process, choice of assemble methods, assemble advantages, social effects of automation. Atomic Assembly Transfer Systems: Continuous transfer, intermittent transfer, Indexing Mechanism, Operator paced free transfer machine.

Unit-V

Design of Manual Assembly: General design guidelines for manual assembly. Assembly efficiency. Classification system for manual handling, Insertion and fastening. Effect of part symmetry, part thickness, size and weight on handling time, parts required for two hands for manipulation, effect of symmetry and chamfer design on insertion operations, Estimation of insertion time.

Teaching Methodology

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2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Books

1. Engineering Design - George E Dieter.
2. Assembly automation and product design, Geoffrey Boothroyd.

Reference Books

1. Henry Peck – “Designing for manufacture”, Sir Isaac Pitman & Sons Ltd.,1973.
2. Matousek – “Engineering Design”, Blackie & sons, 1956.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE - I
SPECIAL MANUFACTURING PROCESS

Course Code: GR14D5113 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- To expose the students to a variety of manufacturing processes including their typical use and capabilities
- To teach the important effects that manufacturing processes may have on the material properties of the processed part with a focus on the most common processes
- To provide a technical understanding of common processes to aid in appropriate material selection for a predetermined process.

Outcomes

- Students will understand and appreciate the latest manufacturing process and apply while working in industry.

Unit-I

Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, Ceramic and Organic methods of coating, Economics of coating. Electroforming, Chemical vapor deposition, Thermal spraying, Ion implantation, Diffusion coating, Diamond coating and Cladding.

Unit-II

Processing of Ceramics & Composites: Applications, Characteristics, Classification. Processing of Particulate ceramics, Powder preparations, consolidation, Drying, Sintering, Hot compaction, Area of application, Finishing of ceramics. Processing of Composites: Composite Layers, Particulate and fiber reinforced composites. Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

Unit-III

Fabrication of Microelectronic devices : Crystal growth and wafer preparation, Film Deposition, Oxidation, Lithography, Bonding and Packing, Yield and Reliability, Printed Circuit boards, Computer aided design in microelectronics, Surface mount technology, Integrated circuit economics.

Unit-IV

E-Manufacturing, Nanotechnology, High speed machining: Rapid Prototyping: Working principles, Methods, Stereo Lithography, Laser Sintering, Fused Deposition method, Applications and Limitations.

Unit-V

Welding and Heat treatment: Solid state Welding Processes: Working Principles, Cold welding, Ultrasonic welding, Friction welding, Resistance welding, Explosion welding and Diffusion Bonding.Heat treating furnaces and equipment, Design Considerations for Heat treating.

Teaching Methodology

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3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Books

1. Manufacturing and Technology/ Kalpakjian/Pearson Education, INC/Forth Edition
2. Process and Materials of Manufacturing/R.a.Lindburg/Forth Edition, PHI
3. Microelectonic packaging hand book/Rao.R.Thummala and Eugene, J.Rymaszcwski/Van Nostrand Renihold.

Reference Books

1. MEMS & Micro systems Design and manufacture/ Tai-Run Hsu / TMGH
2. Advanced Machining Processes/V.K.Jain/Allied Publications
3. Introduction to Manufacturing Processes / John A schey/ Mc Graw Hill

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE - I
FINITE ELEMENT APPLICATIONS IN MANUFACTURING

Course Code: GR14D5114 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- To impart knowledge in the area of finite element methods and its application in manufacturing.
- To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing.

Outcome

- Students will be able to use the FEA in manufacturing applications.

Unit-I

Introduction: Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Raleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation.

Unit-II

One Dimensional Analysis: Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

Unit-III

Shape Functions and Higher Order Formulations: Shape functions for one and two dimensional elements- Three noded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and
axisymmetric analysis.

Unit-IV

Computer Implementation: Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

Unit-V

Analysis of Production Processes: FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Books

1. Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill,1985.
2. Rao, S.S., Finite Element method in engineering, Pergammon press, 1989.
3. Bathe, K.J., Finite Element procedures in Engineering Analysis, 1990

Reference Books

1. Kobayashi,S, Soo-ik-Oh and Altan,T, Metal Forming and the Finite Element Methods, Oxford University Press, 1989.
2. Lewis R.W.Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE - I
QUALITY ENGINEERING IN MANUFACTURING

Course Code: GR14D5115 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- To impart knowledge on quality engineering in product design.
- To study the tolerance design and analysis of variance.
- To study quality standard systems like ISD-9000 Quality system,6-sigma e.t.c.,

Outcomes

- Students will be able to apply quality engineering in manufacturing

Unit-I

Quality Value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design of production processes.Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,S-type and L-type)

Unit-II

Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

Unit-III

Analysis of Variance (ANOVA): NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

Unit-IV

Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contribution, estimating the mean.

Unit-V

ISD-9000 Quality System, BDRE, 6-sigma, Bench making, Quality circles, Brain Storming, Fishbone diagram, problem analysis.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Book

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill, Intl. II Edition, 1995.

Reference Books

1. Quality Engineering in Production systems / G. Taguchi, A. Elsayed et al / Mc.Graw Hill Intl. Edition, 1989.
2. Taguchi Methods explained: Practical steps to Robust Design / Papan P. Bagchi / Prentice Hall Ind. Pvt. Ltd., New Delhi.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE - II
ADVANCED CAD

Course Code: GR14D5116 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- Learn and apply all of the steps of the computer aided design process in proposing and building models in design projects.
- To provide the students with a foundation in computer aided design.
- To produce knowledgeable users of CAD systems.
- To introduce the students to Finite Element Techniques.
- To widen the exposure of the students to contemporary design tools such as optimization and Rapid Prototyping.

Outcomes

- Students develop an understanding of the basic principles underlying computer aided tools used in engineering.
- Students develop awareness in the application of CAD in the context of developing engineering products

Unit-I

Cad Tools: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software.

Geometric modeling: mathematical description of Analytical curves such as Line, Circle, Ellipse, Parabola etc., Problems wire frame models, wire frame entities parametric representation of synthetic curves, hermite cubic splines, Bezier curves B-splines, rational curves, NURBS, Problems

Unit-II

Surface Modeling: Mathematical representation of surfaces, Surface model, Surface entities, Definition of a Patch, surface representation, Parametric representation of surfaces, plane surface, Tabulated Cylinder.

Unit-III

Parametric Representation Of Synthetic Surfaces - Hermite Bicubic surface, Bezier surface, B- Spline surface, COON surface, Surface of Revolution, Ruled Surface, Blending surface, Sculptured surface, Surface manipulation — Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

Unit-IV

Geometricmodelling-3D: Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG). Difference between Feature-based and Parametric based modeling, Description of features such as Extrude, Sweep, Loft, Hole, Extrude-cut etc., CAD/CAM Exchange: Evaluation of data— exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS &DXF.

Unit-V

Design Applications: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis, Preprocessing and Post processing in FEA, Types of Structural, Thermal analysis and Mechanical Assembly.
Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Book

1. CAD/CAM Theory and Practice / Ibrahim Zeid / Mc Graw Hill international.

Reference Books

1. Mastering CAD/CAM / Ibrahim Zeid / Mc Graw lull international.
2. CAD/CAM / P.N.Rao / TMH.
3. CAD/CAM/CIM Radhakrishnan.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE - II
MECHATRONICS

Course Code: GR14D5117 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- To learn the Mechatronics systems such as controls and drives, real time interfacing, data acquisition system, sensors for condition monitoring, mechanical controlling, automated manufacturing.
- To understand the basic concepts, properties and interfacing of controls and drives in the Mechatronics System Design.

Outcome

• Students will be able to design a Mechatronics system such as pick and place robot, car park barriers, car engine management and bar code reader.

Unit-I

Introduction: Definition of Mechatronics products. Design considerations and tradeoffs, over view of mechatronic products. Types of automations and mechatronic elements. Intelligent machine vs. automatic. Economics and social justification. Mechanical Systems, Electromechanical modules, actuators, motion controls and accuracies. Characteristics of electromechanical, Hydraulic, Pneumatic systems and comparison. Control parameters and system objectives, popular control system configuration-S curves. Motor load, Torque Inertia/acceleration torque analysis. Types of motors and speed control sytems

Unit-II

Motion Controls: Motion control algorithms. Significance of feed forward control loops, shortfall, fundamental concepts of adaptive and fuzzy controls. Fuzzy logics compensatory control of transformation and deformation non linear Z-inertia.

Unit-III

RLC, PLC: Architecture of intelligent Machines, Relay logic controllers. Programmable logic controllers. Architecture of PLC. Interfacing, Types of PLC's and selection. Advantages and applications

Unit-IV:

Micro Processors: Introduction to microprocessors and microcontrollers. Programming of microcontrollers. Limitations of microcontrollers.Concepts of embedded systems. COMPUTERS: Manufaturing Data Bases, Database

management systems. CAD/CAM Databases. Graphic database. Introduction to object oriented concepts. Object oriented model languages and interfacing. Procedures and methods in creation, edition and manipulation of Data

Unit-V

Sensors: Types of sensors, mechanical, tactile and non tactile sensors, limit switches, proximity and optic sensors. Analogue & digital sensors and interfacing. Human-machine and Machine-Machine interfacing devices and strategy. Machine vision: Feature and pattern Recognition methods, concepts of perception and recognition in decision making

CNC: Feedback control systems. Encoders & Linear scales Position controls. Coordinated Measuring Machines. CNC software and applications, Flexible manufacturing systems.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Books

1. “Designing intelligent machines” open university, London. Michel B.Histand and David G.Alciatore.”
2. MECHATRONICS - HMT - McGraw-Hill Education
3. Mechatronics by MAHALIK Mc Graw Hill

Reference Books

1. Introduction to Mechatronics and measurement systems Tata MC Graw Hill
2. Control sensors and actuators “prentice Hall”

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE - II
THEORY OF ELASTICITY & PLASTICITY

Course Code: GR14D5118 L:3 T:0 P:0 C:3
I Year I Semester

Objectives

- To study the classical theory of linear elasticity for two and three dimensional state of stress and obtain solutions for selected problems in rectangular and polar coordinates as well as torsion of prismatic bars .
- To understand the plastic stress strain relations, criteria of yielding and elasto- plastic problems.

Outcomes

- Students will have a deep understanding of plasticity theories and will be able to summary, compare and explain them.
- Students will have a deep understanding of the resolution methods of elasto plastic problems, and will be able to summary, compare and explain them. He will also know their application range.
- Students will be able to apply the resolution methods to classical problems of plasticity theory.

Unit-I

Elasticity: Two dimensional stress analysis, Plane stress, Plane strain, Equations of compatibility, Stress function, Boundary conditions.

Problem in rectangular coordinates: Solution by polynomials, Saint Venents Principles, Determination of displacement, Simple beam problems.

Problems in polar coordinates, General equations in polar coordinates- Stress distribution symmetrical about axis, Strain components in polar coordinates, Simple and Symmetric problems.

Unit-II

Analysis of Stress and strain in three dimensions: Principle stresses, Homogeneous deformations, Strain spherical and deviatoric stress, Hydrostatic strain.

General theorems: Differential equations of equilibrium and compatibility, Displacement, Uniqueness of solution, Reciprocal theorem.

Unit-III

Bending of Prismatic bars, Stress function, Bending of cantilever beam, Beam of rectangular cross, section Beams of circular cross, section.

Unit-IV

Plasticity: Plastic deformation of metals, Structure of metals, Deformation, Creep stress relaxation deformation, Strain rate condition of constant maximum shear stress, Condition of constant strain energy approximate equation of plasticity.

Unit-V

Methods of solving practical problems, the characteristic method, Engineering method, Compression metal under press, Theoretical and experimental data drawing.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Books

1. Theory of Elasticity by Timoshenko, S.P. and Goodier.J.N
2. An Engineering Theory of Plasticty by E.P.Unksov.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MANUFACTURING SIMULATION & PRECISION ENGINEERING-LAB

Course Code: GR14A5119 L:0 T:0 P:3 C:2
I Year I Semester

Objectives

- To impart knowledge on how to use FLEXISIM 3.5 Software.
- To gain knowledge on how to improve equipment utilization, reduce waiting time and queue sizes etc,
- To learn PLC and Microcontroller programming.

Outcomes

- Students will be able to use flexisim tool to reduce the unnecessary costs to increase productivity.
- Students will be able to use PLC and Microcontroller programming skills for project related applications.

FLEXISM software

a) Model description & Development
b) Model Development and assigning the parameters
c) Adding Team Operators, Fork Truck transporter,
d) Selection of object for statistics,
e) Viewing the statistics
f) Viewing 3D model
g) Global tables to define routing
h) Set-up a travel path network for a transporter
i) Multiple runs of the model
j) Study of AGV-Auto guided vehicle

Precision Engineering

1) Electro Mechanical 2-Axis X-Y-table
2) Hydraulic / Pneumatic circuits
3) PLC-programming
4) Micro- Controller programming
5) Water Plasma spraying and cutting
6) Study & programming of Robot
7) Study of Chip formation & cutting forces on Lathe machine
8) Study of operation of Tool and cutter grinder-Twist drill
9) Study of Unconventional machining process
10) Condition monitoring of machine tools.

Software's: FLEXISM 3.5, 'MENTOR ' Robotics Program, programmable logical controller, H simulator, Control X sim, LSM controller, P simulator.

Teaching Methodology

1. Lecture is delivered on projector showing the software and its features.
2. Seminars are conducted on new technologies related to subject.
3. Exercises are created to practice of various models.
4. Quiz's are conducted to test the competency level of student with software
5. Industrial visits for practical exposure to understand and explore things

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF HYDRAULIC & PNEUMATIC SYSTEMS

Course Code: GR14D5120 L:3 T:0 P:0 C:3
I Year II Semester

Objectives: By completing this module, the student should be able to:

- Understand the main components of the hydraulic and pneumatic systems
- Design hydraulic and pneumatic circuits.
- Design and understand the electro-hydraulic and electro-pneumatic circuits.

Outcomes

- Students will have a deep understanding of design hydraulic and pneumatic circuits.
- Students will have a deep understanding of Design and understand the electro-hydraulic and electro-pneumatic circuits.

Unit-I

Oil-Hydraulic Systems: Pascals Law, Bramah's press. Bernoulli's principle, Torricelli principle. Fluid properties. Viscocity, Effect of temperatures, dust and decay of Oils .Oil Hydraulic elements and their representation in the circuits. Comparison of Mechanical, Electrical, Hydraulic & Pneumatic systems for force and motion analysis in automation.

Unit-II

Hydraulic Pumps: Classification of Pumps, Gear Pump, Vane Pump, piston Pump, bent axis in line piston pumps. Internal and external Gear pumps. Selection and specification of Pumps.

Actuators: Design of linear Actuators, Cushioning, Seals. Mounting details.Piston rod diameter and its effect on the pressure. Servo Controlled Valves. Hydraulic Counter Balancer Circuit, Sequencing and Synchronising Circuits, Rotary Actuators.

Unit-III

Hydraulic Power Pack: Elements of Power pack. Design of Hydraulic Power pack, Line pressure, Discharge & Motor selection, Power Pack size and capacity. Importance of pressure relief Valve and safety systems. Heating and Cooling systems for Hydraulic Power pack.

Unit-IV

Hydraulic Circuits: Meter-in, Meter-out, Bleed off circuits. Direction Control valves, Solenoid Valves, Flow Control and Pressure control Valves. Pressure compensation, Accumulators.

Pneumatic Circuits: FRL-Unit, Pneumatic line in the Industry, Applications of Pneumatic Equipment. Hydro Pneumatic Circuits.

Unit-V

Automation: Hydraulic and Pneumatic equipment in Automation, Low Cost Automation, Relay Circuits, PLC Circuits, Micro Controllers,

Trouble Shooting: Hydraulic & Pneumatic equipment Trouble Shooting, Simulation software, Sensors, Hydraulic and Pneumatic Equipment maintenance.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Books

1. S.R Majumdar, Oil Hydraulics systems.Tata MC.graw Hill
2. S.R Majumdar, Pneumatic Systems,Principles & maintenance Tata McGraw Hill

Reference Books

1. Andrew Darr, Hydraulic & Pneumatics jaico Publishing House.
2. Antony Esponssito, Fluid Power with applications,Prentice Hall

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

TOTAL QUALITY MANAGENT

Course Code: GR14D5121 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- To study concepts and techniques of TQM.
- To understand concepts of ISO9000 series of quality standards.
- To understand the concepts of costs related to quality.

Outcomes

- Students will be familiarized with the concepts advocated by quality gurus.
- Students will get familiarized with the importance of customer focus in an organization.
- Students will get familiarized with tools involved in improving productivity

Unit-I

Introduction: The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems, Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs., Process control, Statistical Quality Control, Control Charts and Acceptance Sampling.

Unit-II

Customer Focus and satisfaction: Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer-Supplier relationships. Bench marking, Evolution of bench marking, meaning of bench marking, benefits of bench marking, the bench marking process, pitfalls of bench marking.

Unit-III

Organizing for TQM: the systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circle. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

Unit-IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

Unit-V

ISO9000: Universal standards of Quality: ISO around the world, The ISO9000ANSI/ASQCQ-90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Reference Books

1. "Total Quality Management" by Joel E.Ross.
2. "Beyond TQM" by Robert L.Flood.
3. Statistical Quality Control" by E.L.Grant

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER AIDED MANUFACTURING

Course Code: GR14D5122 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- To impart knowledge on NC programming and APT programming.
- To impart knowledge on working of CNC Machine tools and concept of Adaptive control.
- To introduce the concept of post processor, microcontrollers and programmable logic controllers with applications.
- To introduce Expert Systems and Applications.

Outcomes

- Students will be able to understand functioning and programming of CNC machines.
- Students will be able to use microcontrollers, PLC's to design different applications.
- Students will be able to understand structure of different expert systems employed in industries.

Unit I

Computer Aided programming: General information. APT Programming , Examples Apt programming problems (2D machining only).NC programming on CAD/CAM systems, the design and implementation of post processors Introduction to CAD/ CAM software, Automatic Tool Path generation.

Unit-II

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system. Modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control Introduction type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization. Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

Unit-III

Post Processors for CNC: Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor, DAPP, based, Post Processor Communication channels and major variables In the DAPP- based Post Processor, the creation of a DAPP- Based Post Processor.

Unit-IV

Micro Controllers: Introduction. Hardware components, I/O pins, external memory, counters, timers and serial data I/O interrupts. Selection of Micro Controllers Embedded controllers. Applications and Programming of Micro Controllers. Programming Logic Controllers (PLC's): Introducation, Hardware Components of PLC System, basic strucgture, principle of operations, programming mnemonics timers, Internal relays and counters Applications of PLC's in CNC Machines.

Unit-V

Computer Aided Process Planning, Hybrid CAAP System, Computer Aided Inspection and quality control.Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods. Artifical Intelligence and expert system; Artificial Neural Networks, Artitical Intelligence in CAD. Experts systems and its structures.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Books

1. Computer Control of Manufacturing Systems / Yoram Koren / Mc Graw Hill. 1983.
2. Computer Aided Design Manufacturing, K. Lalit Narayn, K. Mallikarjuna Rao and MMM Sarear PHI 2008.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS

Course Code: GR14D5109 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- To gain fundamental understanding of standard micro fabrication techniques and issues surrounding them.
- To know major classes, components and applications of MEMS.
- To demonstrate fundamental principles behind the operation of devices/systems.
- To apply knowledge of micro fabrication techniques and applications to the design and manufacturing of an MEMS device or a micro system.

Outcomes

- Students will be able to understand working principles of currently available micro sensors, actuators, motors, valves, pumps and fluids used in Microsystems.
- Students will be able to use materials for common micro components and devices.
- Students will be able to choose a micromachining technique for a specific MEMS fabrication process.
- Students will be able to understand the basic principles and applications of micro fabrication processes.

Unit-I

Overview and working principles of MEMS and Microsystems: MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & Miniaturization, Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidies.

Unit-II

Engineering Science for Microsystems Design and Fabrication: Atomic Structure of Matter, Ions and lionization, Molecular Theory of Matter and Intermolecular Forces, Doping of Semiconductors. The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

Unit-III

Engineering Mechanics for Microsystems Design: Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics Fracture Mechanics, Thin-Film Mechanics, Overview of Finite Element Stress Analysis.

Unit-IV

Thermo Fluid Engineering & Microsystems Design: Overview of Basis of Fluid Mechanics in Macro and Meso scales, Basic equations in Continuum Fluid Dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible fluid Flow in Micro conduits, Fluid Flow in Sub micrometer and Nano scale, Overview of Heart conduction in Solids, Heat conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design Mechanical Design, Mechanical Design Using FFM, Design of a Silicon Die for a Micro pressure Sensor.

Unit-V

Materials for MEMS & Microsystems and their fabrication: Substrates and Wafers, Active substrate materials. Silicon as a substrate material, Silicon Compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and polymers, photolithography, Ion implantation. Diffusion and oxidation. Chemical and physical vapor deposition. Etching, Bulk micro manufacturing, Surface Micromachining. The LIGA Process.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Book

1. Tai-Ram Hsu,MEMS & Microsystems:Design & Manufacturing , Tata McGraw Hill..ed 2002.

Reference Books

1. Maluf M " An Introduction to Microelectromechanical Systems Engineering'. Artech House,Boston
2. Trimmer, W.S.N," Micro robots and Micromechanical systems," sensors & Actuators, Vol 19 no 1989
3. Trim, D.W, " Applied partial Differential Equations," PWS Kent Publishing, Boston, 1990
4. Madou.M" Fundamentals of Microfabrication," CRC Press, Boca Raton. 1997
5. Hsu, T.R," The Finite Element Method in Thermomechanics," Alicn & Unwin, London. 1986

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
INDUSTRIAL ROBOTICS

Course Code: GR14D5124 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- To study the basic concepts of robotics and various components of Industrial robots.
- To learn about robot programming, artificial intelligence and their applications.

Outcomes

- Students will gain knowledge in design of robots applicable to industries.

Unit-I

Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement. Control System and Components: basic concept and modals controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

Unit-II

Motion Analysis and Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

Unit-III

End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design Sensors: Desirable features, tactile, proximity and range sensors, uses sensors in robotics. Machine Vision: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

Unit-IV

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINGNAL AND DELAY commands, Branching capabilities and Limitations. ROBOT LANGUAGES: Textual robot languages, Generation, Robot language structures, Elements in function.

Unit-V

Robot Cell Desgin and Control: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detection, Work cell controller.

Robot Application: Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Book

1. Industrial robotics, Mikell P.Groover /McGraw Hill.

Reference Books

1. Robotics, K.S.Fu / McGraw Hill.
2. Yoram Koren," Robotics For Engineers' Mc Graw-hill, 1987
3. Kozyrey, Yu. "industrial Robots", Mir Publishers Moscow, 1985.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
TOOL DESIGN

Course Code: GR14D5125 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- The student should learn the design aspects of machine tools, tool holders and basic idea of using cutting fluids during machining
- The student should be able to learn the various types of jigs and fixtures
- The student should be able to understand various press tool operations and various types of press tool dies

Outcomes

- The student should be able to design a tool for increasing the production rate and reducing the overall manufacturing cost
- The designed tools should be of good quality so that the parts are produced with precision
- The student should be able to design the correct die for the required operation
- The designed tools should be safe and easy to operate

Unit-I

Tool Materials: Classification of work & Tool materials. Low carbon, high carbon and alloy steels. Carbides, coated carbides, ceramics, CBN, Diamonds. Abrasive materials

Theory of Metal Cutting Single point tool nomenclature, Wedge angle, Rake angle, Clearance angle, Plan approach angle, Oblique angle Orthogonal cutting & oblique cutting, Shear plane, Merchant Circle. Chip thickness analysis. Tool nomenclature, orthogonal system, Normal rake System, British System, DIN System.

Unit-II

Design of Cutting Tools Single point cutting tools, determination of shank size, Boring tools, Micro bore tools, Multi point tools, Drill nomenclature, end mills, reamers, brazed tools, insert tools, Types of milling cutters, cutting parameters, milling cutters selection, Grinding wheels.

Unit-III

Design of Jig and Fixures: Basic principles of work holding, location and clamping. .Morse & ISO tapers. jig definition and types drill jig bush design., Line boring principles. Vices, milling, boring, lathe, grinding fixtures. CNC tooling, concepts of auto Tool changers.

Unit-IV

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.

U**nit-V**

Design of Metal Bending, Forming and Drawings 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.

Application of Software's Die design by 2D & 3D software's, Cad & Cam software's. CNC machines.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Books

1. Donaldson "Tool Design" Tata McGraw Hill
2. George F Dieter "Mechanical Metallurgy" Tata McGraw Hill

Reference Books

1. Taylor Altan, Sool Ik-Oh and Harold L. Gegel O. "American Society for metals".1983
2. Kurt Lange "Hand Book of metal forming", Mc Graw-Hill.1987
3. Jigs and Fixtures - P. H Joshi - McGraw-Hill 4. Standard Clamping Devices (Grant, 1967).

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
PRODUCTION AND OPERATIONS MANGEMENT

Course Code: GR14D5126 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- To introduce concept of Operation Management.
- To impart knowledge on MRP, JIT and scheduling policies in industrial environment.

Outcomes

- Students will be able to demonstrate an awareness and an appreciation of the importance of the operations and supply management to the sustainability of an enterprise.
- Students will be able to demonstrate a basic understanding of project management.
- Students will be able to demonstrate an awareness of the importance of facility layouts.
- Students will be able to explain the importance of quality control.

Unit-I

Operation Management, Definition, Objectives, Types of Production systems, historical development of operations management, Current issues in operation management. Product design, Requirements of good product design, product development, approaches, concepts in product development, standardization, simplification, Speed to market, Introduction to concurrent engineering.

Unit-II

Value engineering, objective, types of values, function & cost, product life cycle, steps in value engineering, methodology in value engineering, FAST Diagram, Matrix Method. Location, Facility location and layout, Factors considerations in Plant location, Comparative Study of rural and urban sites, Methods of selection plant layout, objective of good layout, Principles, Types of layout, line balancing.

Unit-III

Aggregate Planning, definition, Different strategies, Various models of Aggregate Planning, Transportation and graphical models. Advance inventory control systems push systems, Material Requirement, Terminology, types of demands, inputs to MRP, techniques of MRP, Lot sizing methods, benefits and drawbacks of MRP, Manufacturing Resources Planning (MRP, II), Pull systems, Vs Push

system, Just in time (JIT) philosophy kanban system, Calculation of number of kanbans Requirements for implementation JIT, JIT Production Process, benefits of JIT.

Unit-IV

Scheduling, Policies, Types of scheduling, Forward and Backward Scheduling, Grant Charts, Flow shop Scheduling, n jobs and 2 machines, n jobs and 3 machines, job shop Scheduling, 2 jobs and n machines, Line of Balance.

Unit-V

Project Management, Programming Evaluation Review Techniques (PERT), three times estimation, critical path, Probability of completion of project, critical path method, crashing of simple nature.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Books

1. “Operation Management” by E.s.Buffs
2. “Operation Management” Theory and Problems : by Joseph G. Monks

Reference Books

1. “Operation Management” by E.s.Buffs
2. “Operation Management” Theory and Problems : by Joseph G. Monks
3. “Production Systems Management” by James I. Riggs.
4. “Production and Operation Management “ by Chary.
5. “ Operations Management” by chase
6. “ Production and Operation Management” by panner Selvam
7. “Production and Operation Analysis” by Nahima

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
PERFORMANCE MODELLING AND ANALYSIS OF MANUFACTURING SYSTEMS

Course Code: GR14D127 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- To introduce concept of control of manufacturing systems.
- To impart knowledge on queuing model and networks to control manufacturing processes.

Outcomes

- Students will be able to demonstrate how Kanban system is modeled in industry.
- Students will be able to demonstrate a basic understanding of network models employed in manufacturing industry.

Unit-I

Manufacturing Systems & Control: Automated manufacturing systems, modeling role of performance, simulation models-analytical models. Product cycle manufacturing automation, economics of scale and scope, input/output model, plant configurations. performance measures - manufacturing lead time - work in process -machine utilization - throughput -capacity, flexibility, per formability, quality control systems, control system architecture, factory communications, local area networks interconnection manufacturing automation protocol, database management system.

Unit-II

Manufacturing Processes: Examples of stochastic processes, poisson process discrete time markov chain models, definition and notation, sojourn times in states, examples of dtmcs in manufacturing, chapman kolmogorov equation, steady-state analysis. continuous time Markov chain models, definitions and notation, sojourn times in states, examples of CTMCS in manufacturing, equations for CTMCS evolution, Markov model of a transfer line, birth and death processes in manufacturing, steady state analysis of BD processes, typical BD processes in manufacturing.

Unit-III

Queuing Model: Notation for queues, examples of queues in manufacturing systems, Performance measures, Little's result, steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns, analysis of a flexible machine center.

Unit-IV

Queuing Networks: Examples of QN models in manufacturing, Little's law in queuing networks, Tandem queue, an open queuing network with feedback, an open central server model for FMS, Closed transfer line, Closed server model, Garden Newell networks.

Unit-V

Petrinets: Classical Petri Nets, definitions, transition firing and reach ability, Representational power, properties, manufacturing models. Stochastic Petri Nets, exponential timed Petri Nets, Generalized Stochastic Petri Nets, modeling of KANBAN systems, manufacturing models.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Book

1. Viswanadham, N and Narahari, Y. "Performance Modeling of Automated Manufacturing Systems", Prentice Hall of India, New Delhi, 1994.

Reference Books

1. Trivedi, K.S., "Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall, New Jersey, 1982.
2. Gupta S.C., & Kapoor V.K., "Fundamentals of Mathematical Statistics", 3rd Edition, Sultan Chand and Sons, New Delhi, 1988.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
COMPUTATIONAL FLUID DYNAMICS

Course Code: GR14D5128 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- Describe the physical significance of each term in the governing equations for CFD
- Become familiar with a commercial CFD package to solve practical CFD problems
- Quantify and analyze the numerical error in CFD discetization schemes
- Develop finite difference and finite volume forms of the CFD equations and important model systems
- Formulate explicit and implicit algorithms for solving the Navier-Stokes equations
- Construct computer code to solve the Navier-Stokes equations in 2-D
- Understand and apply verification strategies for evaluating CFD code

Outcomes

Upon completion of this course, students will be able to:

- To develop an understanding for the major theories, approaches and methodologies used in CFD;
- To build up the skills in the actual implementation of CFD methods (e.g. boundary conditions, turbulence modeling etc.) in using commercial CFD codes;
- To gain experience in the application of CFD analysis to real engineering designs.
- Understand and apply the grid generation techniques for solving flow problems.

Unit-I

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations, finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tri diagonal matrix algorithm.

Unit-II

Hyperbolic Equations: Explicit schemes and Von Neumann stability analysis, implicit schems, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge, Kutta method.

Unit-III

Formulations of Incompressible Viscous Flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of Compressible flows: Potential equation, Euler equations Navier, stokes system of equations flow field-dependent variation methods, boundary conditions, example problems.

Unit-IV

Finite Volume Method:

Finite volume method via finite difference method, formulations for two and three dimensional problems.

Unit-V

Standard Variational Methods: Linear fluid flow problems, steady problems, Transient problems.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial visits for practical exposure to understand and explore things.

Text Book

1. Computational fluid dynamics, T.J.C 'hung, Cambridge University Press 2002.

Reference Book

1. Text book of fluid dynamic, Frank Choriton, CBS Publishers & distributors, 1985.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
AUTOMATION IN MANUFACTURING

Course Code: GR14D5129 L:3 T:0 P:0 C:3
I Year II Semester

Objectives

- To impart knowledge on automation of Plant Layout, Production concepts and mathematical models
- To learn about analysis of automated flow lines, assembly systems and line balance
- To learn about automation of material handling systems

Outcomes

Upon completion of this course, students will be able to:

- develop an understanding for the major automation theories, approaches and methodologies used in manufacturing;
- build up the skills in the actual implementation of automation methods

Unit-I

Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation, automation reasons, Production operations and automation strategies, Plant Layout, Production concepts and mathematical models, design the parts for automation, Automatic loading systems.

Unit-II

High Volume Production Systems: Automated flow lines. Methods of work flow, transport transfer mechanism buffer storage, Control functions, Automation for machining operations Design and fabrication considerations.

Unit-III

Analysis of Automated Flow Lines: Analysis of transfer lines without storage, partial automation automated flow lines with storage buffers implementing of automatic flow lines, Line balancing problems, Considerations in assembly line design.

Unit-IV

Assembly Systems and Line Balance: Manual assembly lines, line balancing problem, methods of line balancing, ways to improve line balancing, flexible manual assembly lines, automated assembly systems, analysis of multi station assembly, manufacturing Cells, Automated Cells, Analysis of single station cells.

Unit-V

Automated Material Handling: Types of equipment and functions, design and analysis of material handling system, conveyor system. Automated guided vehicle system, components operation, types, design of automated guided vehicles and applications. Automated storage and Retrieval systems, types, basic components and applications. Transfer lines, Design for Automated Assembly, Partial Automation, Communication Systems in Manufacturing.

Teaching Methodology

1. Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
2. Seminars are conducted on new technologies related to subject.
3. Assignments are given.
4. Group discussions are conducted on familiar topics related to subject.
5. Industrial vists for practical exposure to understand and explore things.

Text Book

1. Mikej P.Grower" Automation, Production Systems and CIM", PHI Pvt, Ltd, 1998.

Reference Books

1. P.Radha Krishan & S. Subrahamanyan and Raju " CAD/CAM/CIM', New Age International Pub , 2003
2. Singh, "System Approach to Computer Integrated Design and manufacturing "John Wiely

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CAD/CAM LAB

Course Code: GR14D5109 L:0 T:0 P:3 C:2
I Year II Semester

Objectives

- To impart knowledge on NC programming of different processes.
- To introduce to machine set up of turning and milling machines.
- To learn about robot programming languages and robot simulation.
- To introduce simulation of manufacturing systems using CAM software to generate route sheets, process sheets etc.,

Outcomes

Students should be able to work on CAM software to generate NC programming, robotic simulation, various reports etc,.

- Features and Selection of CNC turning and milling centers.
- Practice input programming and operation of CNC turning machines, subroutine techniques and use of cycles.
- Practice in part programming and operating a machining center, tool planning and selection of sequences of operations, tool setting on machine,
- Practice in APT based NC Programming.
- Practice in Robot programming and its languages. Robotic simulation using software Robo path control,
- Preparation of various reports and route sheets, Simulation of manufacturing systems using CAM software, controller operation system commands.

Soft wares

CNC XL TURNING MACHINE
CNC XL MILLING MACHINE
FANUC O MILL AND O TURN CONTROLLER
DELMIA V6 R2013
SIMULIA-ABAQUS
FLEXISIM 3.5

Teaching Methodology

1. Lecture is delivered on projector showing the software and its features.
2. Seminars are conducted on new technologies related to subject.
3. Exercises are created to practice of various models.
4. Quiz's are conducted to test the competency level of student with software
5. Industrial vists for practical exposure to understand and explore things.