THREE YEAR COURSE STRUCTURE

FOR

PART TIME M.TECH – MECHANICAL ENGINEERING (CAD/CAM)

w.e.f.

2014-2015 ADMITTED BATCH

DEPARTMENT OF MECHANICAL ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA

Y.S.R. (DIST), ANDHRA PRADESH, INDIA – 516390.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA
Academic Regulations 2014 for M. Tech (PTPG)
(Applicable for the students admitted during the Academic Year 2014 -15 and onwards)

1. ELIGIBILITY FOR ADMISSION:

Admission to the above program shall be made subject to the eligibility, qualification and specialization prescribed by the University for each Program from time to time.

i. Admission shall be made either on the basis of merit/rank obtained by the qualifying candidates in written exam conducted by the University or otherwise specified, whichever is relevant.
ii. The candidates **must be employed** in and around Pulivendula Town.
iii. **COURSES OFFERED**

S.No.	Department	Specialization
01.	Electrical & Electronics Engineering (EEE)	Electrical Power Systems (EPS)
02.	Mechanical Engineering (ME)	Computer Aided Design & Computer Aided Manufacturing (CAD&CAM)
03.	Electronics & Communication Engineering (ECE)	Digital Electronics & Communication Systems (DECS)
04.	Computer Science & Engineering (CSE)	Computer Science & Engineering (CSE)

And any other course as approved by the competent authorities from time to time

2. 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 regulations:

i. He/she has pursued a course of study for not less than six semesters and not more than twelve semesters.
ii. Students who fail to fulfill all the academic requirements for the award of the degree within twelve semesters from the year of their admission, shall forfeit their seat in the course and their seat shall stand cancelled.
iii. Register for 68 credits and secure all 68 credits

3. COURSE WORK:

The programs are offered on a semester basis consisting of six semesters.

i. The candidates undergo three theories and one laboratory course during the first and Third semesters and two theory and one laboratory courses during the second and fourth semesters. During the fifth and sixth semesters the candidates shall pursue the dissertation in the concerned specialization only. The theme of dissertation should conform to the specialization.

ii. There shall be **two seminars** (seminar-I, and seminar -II) related to thesis/dissertation. Out of two seminars related to thesis/dissertation, seminar-I shall be conducted in the V^{th} semester and the seminar-II will be in VI^{th} semester.

iii. A candidate has to either present a paper in any national or international conference organized by AICTE recognized college/institution, or, publish/get acceptance for publication of a paper in peer-reviewed journals before the submission of thesis.

iv. Only on successful completion of all the prescribed courses, the candidate will be permitted to submit the thesis/dissertation. Three copies of the thesis / dissertation certified by the supervisor in the prescribed form shall be submitted to the College. Once a student fails to submit the thesis within the stipulated period of six semesters, extension of time up to twelve semesters may be permitted by the Principal with recommendation of the College Academic Committee.

v. The Thesis/Dissertation will be adjudicated by one external examiner appointed by the Principal.

vi. If the report of the external examiner is favorable, a viva-voce examination shall be conducted by a board consisting of Head of the department, the supervisor and the external examiner who adjudicated the thesis / dissertation. The board shall jointly report the candidate's work as :

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

vii. If the report of the viva-voce is not satisfactory, the candidate will re-register for the viva-voce examination after three months by paying prescribed fee. 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 unless the candidate is asked to revise and resubmit the thesis / dissertation.

4. EVALUATION:

The performance of the candidate in each semester program shall be evaluated subject wise, with a maximum of 100 marks for theory and 50 marks for practical examination, on the basis of Internal Evaluation and End external examination.

i. For the theory subjects 60% of the marks will be for the End external Examination and 40% of the marks will be for Internal Evaluation.

ii. There shall be five units in each of the theory subjects.

iii. Two Midterm Examinations shall be held during the semester. First midterm examination shall be conducted for I & II unit syllabus and second midterm examination shall be conducted for the III, IV & V Unit syllabus. In each midterm exam, a student shall answer all three questions in 2 hours of time without any choice. Final Internal marks for a total of 40 marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage to the better mid exam and 20% to the other.

iv. The following pattern shall be followed in the End Examination.
   a. Five questions shall be set from each of the five units with either/or type for 12 marks each.
   b. All the questions have to be answered compulsorily.
   c. Each question may consist of one, two or more bits.

v. For practical subjects, 60% marks shall be for the End Examinations and 40% marks will be for internal evaluation. The end examination shall be conducted by the concerned laboratory teacher and another examiner from the same department

nominated by the Principal. The internal marks will be awarded by the concerned laboratory teacher based on the performance.

vi. For Seminar, there will be an internal evaluation for 100 marks, with 50 marks in each semester**.** The student shall give a seminar in each semester on the progress of his M.Tech. thesis. He/she has to secure a minimum of 50% to be declared successful. The assessment will be made by a Board consisting of Head of the Department, Thesis supervisor, and one senior faculty member.

vii. A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

viii. In case the candidate does not secure the minimum aggregate marks as specified in 5 (vii) he has to reappear for the semester examination, either in supplementary or in regular, in that subject.

5. **RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL EVALUATION MARKS**

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

i. The candidate should have completed the course work and obtained examinations results for I & II semesters.

ii. He should have passed all the subjects for which the Internal evaluation marks secured are more than 50%.

iii. Out of the theory subjects, if the candidate has failed to obtain 50% of total marks in any subject due to Internal evaluation marks secured being less than 20 marks (50%), then the candidate shall be given one chance for registration of that subject for Improvement of Internal evaluation marks. However, a candidate shall not be permitted for re-registration of more than three such theory subjects.

iv. For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee.

vi. In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects shall stand cancelled.

6. ATTENDANCE:

The candidate shall put in a minimum of 75% attendance in aggregate of all subjects in a semester.

i. Condonation of shortage of attendance up to 10% in any subject i.e. from 65% and above and less than 75% may be given by the College Academic Committee.

ii. Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.

iii. If the candidate has not satisfied the attendance requirements in a semester he/she will have to repeat that semester.

7. AWARD OF DEGREE AND CLASS:

A candidate shall be eligible for the award of M.Tech degree if he/she satisfies the minimum academic requirements in every subject and secures at least satisfactory report on his thesis/dissertation viva-voce examination.

First Class with Distinction	70% or more
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not less than 50%

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

Further, percentage to the extent of 0.5% will be rounded off to next higher digit, to effect change of class from pass class to Second class, Second class to First class, First class to First class with distinction for all the courses being offered, without adding any marks to the original marks secured by the students.

8. WITHHOLDING OF RESULTS:

If the candidate has any dues not paid to the college or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed /promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

9. TRANSITORY REGULATIONS:

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course are eligible for admission to the same or equivalent subjects as and when subjects are offered, subject to 4(viii) and 2(ii) and they will be in the academic regulations into which the candidate is presently readmitted.

10. GENERAL:

The academic regulations should be read as a whole for purpose of any interpretation.

i. The college reserves the right of altering the regulations as and when necessary. The regulations altered may be applicable to all the candidates on rolls.
ii. Wherever the word he, him or his occur, it will also includes she, her.
iii. There shall be no place transfer within the constituent colleges of Jawaharlal Nehru Technological University Anantapur during the entire course of the programme.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING, PULIVENDULA (AUTONOMUS)

Course structure for M.Tech (PTPG) CAD/CAM with effective from 2014-15

M.Tech (PTPG) I- SEMESTER:

S.No.	COURSECODE	SUBJECT	T	P	C
1.	13PT04101	Finite Element Methods	4	-	4
2.	13PT04102	Advances in Manufacturing Technology	4	-	4
3.		Elective -I	4	-	4
	13PT04103	CNC Technology amd Programming			
	13PT04104	Precision Engineering			
	13PT04105	Computer Integrated Manufacturing			
4.	13PT04106	Finite Element Analysis laboratory	0	3	2
TOTAL			12	3	14

M.Tech (PTPG) II-SEMESTER:

S.No.	COURSE CODE	SUBJECT	T	P	C
1.	13PT04201	Geometric Modeling	4	-	4
2.		Elective -II	4	-	4
	13PT04202	Computer Aided Process Planning			
	13PT04203	Computational Methods			
	13PT04204	Artificial Intelligence in Manufacturing			
3.	13PT04205	Modeling Laboratory	-	3	2
TOTAL			8	3	10

M.Tech (PTPG) III - SEMESTER:

S.No.	COURSE CODE	SUBJECT	T	P	C
1.	13PT04301	Robotics	4	-	4
2.	13PT04302	Mechatronics	4	-	4
3.		Elective-III	4	-	4
	13PT04303	3D Printing			
	13PT04304	Discrete Event Simulation			
	13PT04305	Fluid Power Systems			
	13PT04306	Automation & Simulation Laboratory	-	3	2
TOTAL			12	3	14

M.Tech (PTPG) IV - SEMESTER:

S.No.	COURSE CODE	SUBJECT	T	P	C
1.	13PT04401	Advanced Optimization Techniques	4	-	4
		Elective -IV			
2.	13PT04402	Design For Manufacturing	4	-	4
	13PT04403	Computational fluid dynamics			
	13PT04404	Supply chain Management			
3.	13PT04405	Computer Numerical Control Laboratory	-	3	2
TOTAL			**8**	**3**	**10**

M.Tech (PTPG) - V SEMESTER:

S.No	*COURSE CODE*	Subject	Maximum Marks		Total	Credits
			Internal	External		
1.	13PT04501	Thesis Seminar – I	50		50	-

M.Tech (PTPG) - VI SEMESTER:

S.No	*COURSE CODE*	Subject	Maximum Marks		Total	Credits
			Internal	External		
1.	13PT04601	Thesis Seminar – II	50		50	-
2.	13PT04602	Project Work Grades: A, B, C, D A – Excellent B – Good C – Satisfactory D – Unsatisfactory	---	---	---	20

M.Tech (PTPG) I- SEMESTER (CAD/CAM):

FINITE ELEMENT METHODS

L	T	P	C
4	0	0	4

Course Objectives:

- **To equip the students with the Finite Element Analysis fundamentals.**
- **To enable the students to formulate the design problems into FEA.**
- **To introduce basic aspects of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays,**
  and solution of the resulting algebraic systems.

UNIT - I

Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements. Variational methods – potential energy method, Raleigh Ritz method, strong and weak forms, Gelerkin and Weighted residual methods, calculus of variations, Essential and natural boundary conditions.

UNIT – II

One-Dimensional Finite Element Methods: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin,

UNIT – III

Trusses: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects- 1D problems only.

BEAMS AND FRAMES: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses- 1D problems only.

UNIT - IV

Two Dimensional Problems: CST, LST, four node and eight node rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin.

UNIT – V

Finite Elements In Structural Dynamics: Dynamic equations, Eigen value problems, and their solution methods, simple problems.

CONVERGENCE: Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, Pascal's triangle.

TEXT BOOK:

1. Ashok D. Belegundu, Tirupathi R. Chandrupatla, Introduction to Finite Elements in Engineering, PHI Learning, 2009.
2. Singiresu S Rao, The Finite Element Method in Engineering, Elsevier, 2012.
3. Daryl L. Logan, A First Course in the Finite Element Method, Cl-engineering, 2010

REFERENCES:

1. J.N. Reddy, Finite element method in Heat transfer and fluid dynamics, CRC press,1994
2. Zienckiwicz O.C. & R. L. Taylor, Finite Element Method, McGraw-Hill,1983.
3. J. N. Oden, Finite Element of Nonlinear continua, McGraw-Hill, New York, 1971
4. K. J. Bathe, Finite element procedures, Prentice-Hall, 1996

Course Outcomes:

Upon completing this course, the students will be able to:

- **Identify mathematical model for solution of common engineering problems.**
- **Formulate simple problems into finite elements.**
- **Solve structural, thermal, dynamic problems.**
- **Use professional-level finite element software to solve engineering problems in Solid mechanics, heat transfer and Dynamics.**
- **Derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts.**

M.Tech (PTPG) I- SEMESTER (CAD/CAM):

ADVANCES IN MANUFACTURING TECHNOLOGY

L	T	P	C
4	0	0	4

Course Objectives*:*

- To understand the basic principles of welding processes.
- To understand the fundamentals of unconventional machining methods.
- To develop the students ability to apply modern machining methods on welding
- To introduce the students of various types of welding and their performance characteristics.

UNIT - I

Welding Processes: Fusion and Solid State Welding Process, Automation in Welding, Design aspects of welds, Weldability of Aluminium alloys, Titanium alloys and High strength low alloy steels, Non destructive testing of Welds, Residual Stresses and Distortion in weldments.

UNIT - II

Un-Conventional Machining Methods-I:

Abrasive jet machining - Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent developments.

Ultrasonic Machining: Elements of the process, machining parameters, Effect of parameters on surface finish and metal removal rate, mechanics of metal removal process parameters, economic considerations, applications and limitations**.**

UNIT - III

Un-Conventional Machining Methods-II: Electro-Chemical Processes: Fundamentals of electro chemical machining, metal removal rate in ECM, Tool design, Surface finish and accuracy economics aspects of ECM.

WIRE EDM PROCESS: General Principle and applications of Wire EDM, Mechanics of metal removal, Process parameters, and selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy.

UNIT - IV

Un-conventional Machining Methods-III:

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, principle, advantages, and limitations, comparison of thermal and non-thermal processes.

Plasma Arc Machining: Principle, machining parameters, effect of machining parameters on surface finish and metal removal rate, applications, limitations

Laser Beam Machining: Principle, effect of machining parameters on surface finish, applications, and limitations.

UNIT - V

Surface Processing Operations: Plating and Related Processes, Conversion Coatings, Physical Vapor Deposition, Chemical Vapor Deposition, Organic Coatings, Porcelain Enameling and other Ceramic coatings, Thermal and Mechanical Coating Processes.

TEXT BOOKS:

1. **Manufacturing Technology by P. N. Rao, TMH Publishers**
2. **Fundamentals of Modern Manufacturing by Mikell P. Groover, John Wiley & Sons Publishers**
3. **Modern Machining Process by P.C Pandey and H.S Shan, Tata McGraw - Hill Education (1980)**
4. **Manufacturing Engineering and technology by Serope Kalpakjian & Stephen Schmid**

REFERENCES:

1. **Production Technology by R.K Jain, Khanna publishers (2011)**
2. **Manufacturing Science by Amitabha Ghosh, Asok Kumar Mallik, East West press**
3. **Welding Technology by R.S, Parmar, Khanna Publishers (2013)**
4. **Introduction to Nanotechnology by Poole and Owens, Wiley (2003).**

***Course Outcomes**:*

Upon completing this course, the students will be able to:

- Understand the principles of welding processes
- Acquire working knowledge on unconventional machining methods
- Describe the principle and fundamentals of welding
- Familiar with the various applications of welding

M.Tech (PTPG) I- SEMESTER (CAD/CAM):

CNC TECHNOLOGY AND PROGRAMMING

(Elective – 1)

L	T	P	C
4	0	0	4

Course Objectives:

- To get brief idea about Fundamentals and concepts of CNC machining centers, NC machines
- To get fundamentals and concepts in Maintenance and Trouble shooting of CNC & NC machine tools.
- To state the objectives, advantages, and special requirements concerning CNC, NC & DNC use.
- To identify the different media used to input and store CNC programs.

UNIT – I

Introduction To Cnc Machine Tools: Evolution of Computerized control in manufacturing, Components, Working principle of CNC, DNC and Machining centers.

UNIT – II

Constructional Features Of Cnc Machine Tools: Introduction, Spindle drives, Transmission belting, axes feed drives, Slide ways, Ball screws**.**

Accessories: Work tables, Spindles, Spindle heads, Beds and Columns, Tooling – Automatic Tool changer (ATC).

UNIT – III

Electro-Magnetic Analogue Position Transducers: Principle, advantages, characterstics, Synchros, Synchro-Resolvers, Inductos, Laser interferometer.

Control Systems And Interface: Open and closed loop systems, Micro processor based CNC systems, block diagram of typical CNC system, description of hard ware and soft interpolation systems, Standard and optional features of CNC control systems.

UNIT – VI

Nc Part Programing : Introduction, NC coordinate system, Manual Part Programming, Codes and concepts, types of tape farmats**.**

APT Programming: APT language structure, APT geometry, Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to point motion commands, continuous path motion commands, post processor commands, control commands, Macro subroutines, Part programming preparation for typical examples**.**

UNIT – V

Economics And Maintenance Of Cnc Machine Tools: Introduction, factors influencing selection of CNC machines, Cost of operation of CNC machines, Maintenance features of CNC machines, Preventive maintenance, Documentation, Spare parts, Training in Maintenance.

TEXT BOOKS:

i. Computer Control of Manufacturing systems by Y.Koren, Khanna publications.
2. Computer Numerical Control Machines by Hans B.Keif and T. Frederick Waters Macmillan/McGraw Hill.
3. CAD/CAM by CSP Rao, Scitech publications

REFERENCES:

1. Computer Numerical Control Machines by Dr.Radha Krishnanan, New Central Book Agency
2. CNC Machines by B.S. Aditahn and Pabla
3. CNC Machining technology by Smith & Graham.T Springer – Verlag
4. Computer Numerical Machine tools by G.E. Thyer, NEWNES
5. CAD/CAM – PN Rao
6. Introduction to CNC – James V.Valentine & Josoph goldenberg
7. CAD/CAM – M.P.Groover & E.W.Zimmers

Course outcomes

Upon completing this course, students will be able to:

- Understand fundamentals of NC/CNC
- Learn and Write NC Part Programming
- Learn NC Programming through CAD/CAM
- Learn Tooling for NC/CNC
- Understand machines like Chucking and Turning centers, Machining centers
- Learn Maintenance and Trouble Shooting of CNC Machine Tools

M.Tech (PTPG) I- SEMESTER (CAD/CAM):

PRECISION ENGINEERING

(Elective – 1)

L	T	P	C
4	0	0	4

UNIT - I

Tolerances And Fits: ISO and ISI designation, Calculation of clearance and Interference fits, Probability of clearance and Interference fits in Transitional fits, Examples of application of various fits, Concept of selective assembly, Calculation of fits in selective assembly.

UNIT – II

Concept Of Part And Machine Tool Accuracy: Accuracy specification of parts and assemblies, accuracy of machine tools, Alignment testing of machine tools.

Theory Of Dimensional Chains: Definitions, Concept of dimensional chain or tolerance stack. Examples of right and wrong dimensioning, basic theory of dimensional chain, Calculation of tolerances in dimensional chains

UNIT - III

Errors During Machining: Errors due to compliance of machine fixture tool work piece [MFTW] system. Influence of compliance on progressive decrease of error in a series of machining operations, theory of location, location errors, errors due to geometric inaccuracy of machine tool, errors due to tool wear. Errors due to thermal effects, errors due to clamping, statistical methods of accuracy analysis

UNIT – IV

Surface Roughness: Definition and measurements, Surface roughness indicators (CLA, RMS, et.,) and their comparison, Influence of machining conditions. Methods of obtaining high quality surfaces, Lapping, Honing, Super finishing and Burnishing Processes

UNIT – V

Calculation Of Machining Allowances: In process dimensioning of work pieces with examples.

Manufacturing Methods Of Typical Machine Tool Components: Spindles, Lead screws and beds

TEXT BOOK:

1. James D Meadows " Geometric Dimensioning and Tolerancing" 2014, CRC Press
2. Precision Engineering in manufacturing by R.L Murthy, New Age Publications
3. V.Kovan, "Fundamentals of process Engineering" Foreign Languages Publishing House, Moscow
4. Eary and Johnson, "Process engineering for Manufacture"

Reference Books:

1. B. Balakshin, "Fundamentals of Manufacturing Engineering", MIR Publishers, Moscow(1971)
2. J.L.Gadjala, "Dimensional Control in Precision Manufacturing"
3. V.Danilevsky, "Manufacturing Engineering**".**

M.Tech (PTPG) I- SEMESTER (CAD/CAM):

COMPUTER INTEGRATED MANUFACTURING

(Elective – 1)

L	T	P	C
4	0	0	4

Course Objectives*:*

- To develop an understanding of the role of computer in manufacturing
- To introduce hardware and software components for soft automation.
- To provide an in-depth understanding of control of manufacturing, automated material handling, storage and retrieval systems.
- To take up case studies on FMS and CIM systems

UNIT-I

Introduction

Objectives of a manufacturing system –indentifying business opportunities and problems classification production systems- linking manufacturing strategy and systems- analysis of manufacturing operations

UNIT-II

Computer Aided Planning And Control

Production planning and control-cost planning and control-inventory management- Material requirements planning (MRP)- shop floor control-Factory data collection system – Automatic identification system-barcode technology – automated data collection system

UNIT-III

Computer Monitoring

Types of production monitoring systems- structure model of manufacturing process- process control & strategies- direct digital control- supervisory computer control – computer in QC – contact inspection methods, non-contact inspection method – computer –aided testing – integration of CAQC with CAD/CAM

UNIT-IV

Integrated Manufacturing System

Definition – application – features – types of manufacturing systems-machine tools- materials handling system – computer control system – DNC systems manufacturing cell Flexible manufacturing systems (FMS) –the FMS concept – transfer systems – head changing FMS – variable mission manufacturing system benefits. Rapid prototyping – Artificial Intelligence and Expert system in CIM

UNIT-V

Material Handling In Manufaturing System

Material handling function, Types of material handling equipment, AGV systems, Automated Storage/ Retrieval systems, Interfacing handling and storage with manufacturing

TEXT BOOKS:

1. Groover, M.P., "Automation, Production system and CIM", Prentice – Hall of India, 1998.
2. Davis Bedworth, " Computer Integrated Desingn and Manufacturing", TMH, New Delhi,

REFERENCE:

1. Yorem Koren, " Computer Integrated Manufacturing", McGraw Hill,1983
2. Ranky, Paul G., "Comuter Integrated Manufaturing", Prentice Hall International
3. R.W.Yeomamas, A.Choudary and P.J.W.Ten Hagen, "Desingn rules for a CIM system",
4. PN RAO , " CAD/CAM", (PHI)
5. CSP Rao – CAD/CAM

Course Outcomes:

After completion of the course, the students will be able to:

- Apply the principles of operation of automated material handling, storage, and retrieval systems (ASRS) and implement them in production..
- Implement group technology concepts in production to facilitate cellular and flexible manufacturing.
- Take appropriate strategy to gradually migrate from conventional manufacturing to FMS and CIM

M.Tech (PTPG) I- SEMESTER (CAD/CAM):

FINITE ELEMENT ANALYSIS LABORATORY

L	T	P	C
0	0	3	2

Course Objectives

- To use the commercial Finite Element packages to build Finite Element models and solve a selected range of engineering problems.
- To validate a Finite Element model using a range of techniques.
- To communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained.
- To discuss the accuracy of the Finite Element solutions.

FE Analysis using ANSYS Package for different structures that can be descretized with 1-D,2-D & 3-D elements to perform the following analysis:

1. **Static Analysis**
   - **a.** Stress analysis of 2D truss.
   - **b.** Stress analysis of a plate with a circular hole and L-Bracket – 2D and 3D
   - **c.** Stress analysis of beams (cantilever, simply supported & fixed ends)
   - **d.** Stress analysis of an axi-symmetric component

2. **Thermal Analysis**
   - **a.** Conductive heat transfer analysis of a 2D and 3D components
   - **b.** Convective heat transfer analysis of a 2D component
   - **c.** Coupled field analysis of a component

3. **Modal Analysis**
   - **a.** mode frequency analysis of a 2D component
   - **b.** mode frequency analysis of beams (cantilever, simply supported, Fixed ends)

4. **Transient analysis**
   - **a.** Transient analysis of a cantilever beam

Course outcomes

- Ability to solve engineering problems using the commercial software's like ANSYS, SIMUFACT, ABAQUS, SIMULIA.

M.Tech (PTPG) II- SEMESTER (CAD/CAM):

GEOMETRIC MOELLING

L	T	P	C
4	0	0	4

Course Objectives*:*

- To Learn advanced concepts of feature based modeling and parametric modeling
- To understand the mathematical basis for geometric modeling of curves and surfaces and their relationship with computer graphics.
- To understand the methods of representation of wireframe, surface, and solid modeling systems.
- To Consider data associativity concepts of CAD/CAE integration; Be familiar with interoperability and data transfer techniques between design and analysis software systems.

UNIT - I

Introduction: Definition, Explicit and implicit equations, parametric equations.

UNIT - II

Cubic Splines: Algebraic and geometric form of cubic spline, tangent vectors, parametric space of a curve, blending functions, four point form, reparametrization, truncating and subdividing of curves.

Cubic Splines: Graphic construction and interpretation, composite pc curves.

UNIT - III

Bezier Curves: Bernstein basis, equations of Bezier curves, properties, derivatives.

B-Spline Curves: B-Spline basis, equations, knot vectors, properties, and derivatives.

UNIT – IV

Surfaces: Bicubic surfaces, Coon's surfaces, Bezier surfaces, B-Spline surfaces, surfaces of revolutions, Sweep surfaces, ruled surfaces, tabulated cylinder, bilinear surfaces, Gaussian curvature.

UNIT – V

Solids: Tricubic solid, Algebraic and geometric form.

Solid Modeling Concepts: Wire frames, Boundary representation, Half space modeling, spatial cell, cell decomposition, classification problem.

TEXT BOOKS:

1. CAD/CAM by Ibrahim Zeid, Tata McGraw Hill.
2. Elements of Computer Graphics by Roger & Adams, Tata McGraw Hill.

REFERENCES:

1. Geometric Modeling by Micheal E. Mortenson, McGraw Hill Publishers
2. Computer Aided Design and Manufacturing, K.Lalit Narayan, K.Mallikarjuna Rao, MMM Sarcar, PHI Publishers

Course Outcomes:

Upon completing this course, the students will be able to:

- Represent curves and surfaces using parametric equations
- Define and relate the basic concepts, tools, and algorithms in geometric modeling and digital surface processing
- Critically analyze and assess current research on surface representations and geometric modeling with the intent to apply the proposed methods in your own work
- Define the methods of representation of wireframe, surface, and solid modeling systems.

M.Tech (PTPG) II- SEMESTER (CAD/CAM):

COMPUTER AIDED PROCESS PLANNING

(Elective – II)

L	T	P	C
4	0	0	4

Course Objectives:

- To help the students develop an understanding of the underlying knowledge and related methods of Computer Aided Process Planning, and
- To equip the students with the skills required in carrying out the process planning (PP) function within a computer integrated manufacturing environment.
- To introduce group technology and concurrent engineering, and develop skill in the developing automated process plans using variant and generative approaches

UNIT - I

Introduction To Capp: Information requirement for process planning system, Role of process planning, advantages of conventional process planning over CAPP, Structure of Automated process planning system, feature recognition, methods.

UNIT - II

Generative Capp System: Importance, principle of Generative CAPP system, automation of logical decisions, Knowledge based systems, Inference Engine, implementation, benefits.

Retrieval Capp System: Significance, group technology, structure, relative advantages, implementation, and applications.

UNIT - III

Selection Of Manufacturing Sequence: Significance, alternative manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples.

UNIT –IV

Determination Of Machining Parameters: reasons for optimal selection of machining parameters, effect of parameters on production rate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

Determination Of Manufacturing Tolerances: design tolerances, manufacturing tolerances, methods of tolerance allocation, sequential approach, integration of design and manufacturing tolerances, advantages of integrated approach over sequential approach.

UNIT –V

Generation Of Tool Path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods.

Implementation Techniques For Capp: MIPLAN system, Computer programming languages for CAPP, criteria for selecting a CAPP system and benefits of CAPP. Computer integrated planning systems, and Capacity planning system.

TEXT BOOKS:

1. Automation , Production systems and Computer Integrated Manufacturing System – Mikell P.Groover
2. Computer Aided Design and Manufacturing – Dr.Sadhu Singh.
3. Computer Aided Engineering – David Bedworth

REFERENCES:

1. CAD/CAM By CSP Rao.
2. CAD/CAM by PN Rao.

Course Outcomes:

After completion of the course, the students will be able to:

- Describe the process planning functions, the role of process planning in manufacturing, the characteristics of traditional and Computer Aided Process Planning (CAPP) systems, and the structure of typical CAPP systems from a holistic prospective.
- Identify the process capabilities, such as process parameters, process boundaries, process performance and process cost in the areas of manufacturing.
- Apply group technology, geometric coding systems, electronic product information representation methods, and process data representation methods to encode part and process information within machining or electronic products manufacturing environment.
- Implement Manual and Computer Aided Process Planning systems in consideration of process planning criteria, and industrial considerations.

M.Tech (PTPG) II- SEMESTER (CAD/CAM):

COMPUTATIONAL METHODS
(Elective - II)

L	T	P	C
4	0	0	4

Course Objectives*:*

- To develop mathematical models of lower level engineering problems.
- To learn how to calculate, quantify, and minimize errors, concept of significant digits and how errors are related to correct number of significant digits.
- Students will learn how to solve nonlinear equations numerically
- Students will be introduced to fundamental matrix algebra concepts and shown how to solve simultaneous linear equations numerically
- Students will learn how to numerically integrate continuous and discrete functions.
- Students will learn how to numerically solve ordinary differential equations that are initial value or boundary value problems.

UNIT – I

Numerical Solutions Of Linear & Non Linear Equations: System of Linear Equations– Iterative methods – Relaxation methods – System of non-linear equations –Method of Iteration, Newton Raphson method- computer programs

Numerical Integration: Newton-Cotes integration formulas – Simpson's rules, Gaussian quadrature. Adaptive integration.

UNIT – II

Boundary Value Problems: Finite Difference Method, Cubic Spline Method & Shooting method

Numerical Solutions Of Partial Differential Equations: Laplace's equations – Jocobi's Method, Gauss Seidel Method & ADI method. Finite element method- Rayleligh-Ritz Method & Galerkin's Method.

UNIT – III

Parabolic Partial Differential Equations: Explicit method – Crank-Nickelson method – Derivative boundary condition – Stability and convergence criteria – Finite element for heat flow – computer programs.

UNIT – IV

Hyperbolic Partial Differential Equations: Solving wave equation by finite differences-stability of numerical method –method of characteristics-wave equation in two space dimensions-computer programs.

UNIT – V

CURVE FITTING AND APPROXIMATION OF FUNCTIONS: Least square approximation fitting of non-linear curves by least squares –regression analysis- multiple linear regression, non linear regression - computer programs.

OPTIMIZATION:

One dimensional unconstrained optimization, multidimensional unconstrained optimization –direct methods and gradient search methods, constrained optimization.

TEXT BOOKS:

1. Steven C.Chapra, Raymond P.Canale "Numerical Methods for Engineers" Tata Mc-Graw hill
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Publication, 5th Edition(2012).
3. Douglas J..Faires,Riched Burden"Numerical methods"Brooks/cole publishing company, 1998. Second edition.

REFERENCES:

1. Ward cheney & David Kincaid "Numerical mathematics and computing" Brooks/cole publishing company1999, fourth edition.
2. Riley K.F.M.P.Hobson&Bence S.J,"mathematical methods for physics and engineering, Cambridge university press,1999.

Course Outcomes:

After completion of this course the student should be:

- Understand the concept and steps of problem solving - mathematical modeling, solution and implementation.
- Solve the boundary value problems also Familiarity with statistics and linear algebra.
- Apply advanced mathematics through multivariate calculus and differential equations.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs.
- An ability to identify, formulates, and solve engineering problems.

M.Tech (PTPG) II- SEMESTER (CAD/CAM):

ARTIFICIAL INTELLIGENCE IN MANUFACTURING

(Elective – II)

L	T	P	C
4	0	0	4

Course objectives

- To get brief idea about fundamentals and concept of artificial intelligence.
- Find appropriate idealizations for converting real world problems into AI search problems formulated using the appropriate search algorithm.
- Given a real world supervised learning problem, choose and implement appropriate learning algorithms such as decision trees, support vector machines, and boosting.

UNIT-I

Artificial Intelligence : Introduction, definition, underlying assumption, Important of Al, Al & related fields State space representation, defining a problem, production systems and its characteristic, search and control strategies –Introduction, preliminary concepts, examples of Search , problems.

UNIT-II

Uniformed Or Preliminary Concept: Examples of search problems, Uniformed or Blind Search, Informed Search, Or Graphs, Heuristic Search techniques- Generate and Test, Hill climbing, Best first search, Problem reduction, Constraint satisfaction, Means- Ends Analysis.

Knowledge Representation Issues: Representations and Mapping, Approaches, Issues in Kr, Types of knowledge procedural Vs Declarative, Logic programming, Forward Vs Backward reasoning, Matching, Non monotonic reasoning and it logic.

UNIT-III

Use Of Predicate Logic: Representing simple facts, Instance and is a relationships, Syntax and Semantics for Propositional logic, FOPL, and properties of Wffs, conversion to casual form, Resolution, Natural deduction

Statistical And Probabilistic Reasoning: Symbolic reasoning under uncertainly, Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster- Shafer Theory, Fuzzy Logic.

UNIT-IV

Expert Systems: Introduction, Structure and uses, Representing and using domain knowledge, Expert System Shells. Pattern recognition, introduction, Recognition and classification process, learning classification patterns, recognizing and understanding speech.

Introduction To Knowledge Acquisition: Types of learning, General learning model, and performance measures.

UNIT-V

Typical Expert Systems: MYCIN, Variants of MYCIN, PROSPECTOR DENDRAL, PRUFF etc.
Introduction To Machine Learning: Perceptons, Checker Playing examples,Learning, Automata, Genetic Algorithms, Intelligent Editors.

TEXT BOOKS

1. Elaine Rich & Kevin Knight, " Artificial Intelligence" , M/H 1983
2. Wendry B.Ranch, "Artificial Intelligence in Business", Science & Industry – Vol -II application, Ph 1985.

REFERENCES:

1. Waterman, D.A., Addison, " A Guide to Expert System" – Wesley inc. 1986.
2. Hayes, Roth, Waterman, "Building expert system" D.A (ed), AW 1983.
3. S.M. and Kulliknowske, "Designing Expert System", Weis, London Champion Hull 1984.

Course outcomes

Upon completing this course, students will be able to:

- The student will learn the basics of the theory and practice of Artificial Intelligence as a discipline about intelligent agents capable of deciding what to do, and do it.
- The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.
- The student will design simple software to experiment with various AI concepts and analyze results.
- The student will build self-learning and research skills to be able to tackle a topic of interest on his/her own or as part of a team.

M.Tech (PTPG) II- SEMESTER (CAD/CAM):

MODELLING & CFD LABORATORY

L	T	P	C
0	0	3	2

Course Objectives:

- To train the students with CAD packages.
- To impart the 2D and 3D modeling skills to the students.
- To import and export different IGES files from one software to another

1. **Generation of the following curves using "C" language**
   - **a)** Bezier curves
   - **b)** Splines
   - **c)** B-Splines**.**
2. **Generation of the following surfaces using "C" language**
   - **a)** Bezier surfaces
   - **b)** B-Splines surfaces
3. **Generation of solids using "C"**
   - **a)** Constructive solid geometry
   - **b)** Boundary representation
4. **Typical tasks of Modeling using PRO/E, IDEAS, CATIA solid modeling packages**
   - **a)** Surface modeling
   - **b)** Solid Modeling
   - **c)** Drafting
   - **d)** Assembly

Course Outcomes:

- Students will be able to design different parts of mechanical equipments
- Students will be able to apply their skills in various designing and Manufacturing Industries.
- Ability to apply knowledge of basic science and engineering fundamentals.
- Ability to communicate effectively, not only with engineers but also with the community at large In-depth technical competence in at least one engineering discipline.

M.Tech (PTPG) III- SEMESTER (CAD/CAM):

ROBOTICS

L	T	P	C
4	0	0	4

Course objectives

- **To design, develop and complete robotic activities and challenges**
- **This course aims at providing the students the fundamental knowledge of the various subscriptions such as kinematics, Dynamics, controls, sensors, actuators, etc.**
- **It is aimed to provide adequate background in both analysis and design of robots.**

UNIT – I

Fundamentals Of Robots: Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots. Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

UNIT – II

Kinematics Of Robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation,Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, The inverse kinematic of robots, Degeneracy and Dexterity, simple problems with D-H representation.

Differential Motions And Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

UNIT – III

Dynamic Analysis And Forces: Introduction, Lagrangian mechanics, Effective moments of inertia, dynamic equations for multi-degree of freedom robots-kinetic enrgy,potential energy, the Lagrangian – Eulers and Newton-Eulers equations of motion.

UNIT – VI

Trajectory Planning: Introduction, path Vs trajectory, basics of trajectory planning, joint space trajectory planning-third order polynomial trajectory planning, fifth order polynomial trajectory planning, Cartesian-space trajectories.

UNIT – V

Robot Sensors: Introduction, sensor characteristics, Position sensors- Velocity sensors-accelerating sensors, touch and tactile sensors, force and pressure sensors-piezoelectric, force sensing resistor, strain gauges, Torque sensors, light and infrared sensors, proximity sensors, sniff sensors.

Robot Vision: Introduction, the sensing and digitizing function in Machine Vision, image processing and analysis, Training and vision system vision application in robots.

TEXT BOOKS:

1. Introduction to Robotics – Analysis, System, Applications by Saeed B. Niku, PHI Publications
2. Industrial Robotics – Mikell P. Groover & Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey – Mc Graw Hill, 1986

REFERENCES:

1. Robot Modeling and Kinematics – Rachid Manseur, Firewall Media Publishers (An imprint of Laxmi Publications Pvt. Ltd., New Delhi)
2. Robot Analysis and Control - H. Asada and J.J.E. Slotine John Willey & Sons.
3. Fundamentals of Robotics: Analysis and control, Robert J. Schilling, Prentice Hall, 1990.
4. A robot Engineering text book – Mohsen shahinpoor, Harper & Row Publishers,1987
5. Introduction to Robotics: Mechanics and Control, John.J.Craig, Addison- Wesley, 1999
6. Robotics: Control, sensing, vision, and intelligence – K.S. FU, R.C. Gonzalez and C.S.G Lee. Mc Graw Hill, 1987.
7. Modeling and control of Robot manipulators, L. sciavicco and b. Siciliano, Springer (second edition) 2000.
8. ROBOTICS (Fundamental concepts and analysis)ASHITAVA GHOSAL. Oxford university

Course outcomes

By studying this course, students will be

- Familiar with the history, concept development and key components of robotics technologies.
- Understand basic mathematic manipulation of spatial coordinate representation and transformation.
- Understand and able to solve basic robot forward and inverse kinematic problems.
- Understand and able to solve robotic dynamics, path planning and control problems.
- Able to undertake practical robotics experiments that demonstrate the above skills.

M.Tech (PTPG) III- SEMESTER (CAD/CAM):

MECHATRONICS

L	T	P	C
4	0	0	4

Course Objectives*:*

- To understand the technologies behind modern mechatronic systems.
- To provide methodological fundamentals for the development of fully automated system.
- To teach students how to develop a robotic or automated system project focusing on the hardware and software integration, and
- To apply the acquired knowledge for developing a mechatronic system.

UNIT – I

Introduction: Definition of Mechatronics products, design considerations and tradeoffs. Overview of Mechtronic products, Intelligent machine Vs Automatic machine economic and social justification.

UNIT – II

Motion Control: Control parameters and system objectives, Mechanical Configurations, Popular control system configurations. S-curve, motor/load inertia matching, design with linear slides.

Motion Control Algorithms: Significance of feed forward control loops, shortfalls, fundamentals concepts of adaptive and fuzzy – control. Fuzzy logic compensatory control of transformation and deformation non- linearity's.

UNIT – III

Architecture Of Intelligent Machines: Introduction to Microprocessor and programmable logic controls and identification of systems. System design classification, motion control aspects in design.

UNIT – IV

Manufacturing Data Bases: Data base management system, CAD/CAM data bases, graphic data base, introduction to object oriented concepts, objects oriented model language interface, procedures and methods in creation, edition and manipulation of data.

UNIT – V

Machine Vision: Feature and pattern recognition methods, concepts of perception and cognition in decision-making, human-Machine and machine- Machine inter facing devices and strategy.

TEXT BOOKS:

1. Designing intelligent machines, Michel B.Histand and David G. Alciatore, open university London.
2. Introduction to Mechatronics and Measurement systems, by W.Bolton, Tata Mc Graw Hill.

REFERENCES:

1. Control sensors and actuators by C.W.desilva, Prentice Hall.
2. Mechatronics by Rajput, S.Chand Publications.
3. Mechatronics by HMT

Course Outcomes

Upon successful completion of this unit, the student will be able to:

- Define the discipline of mechatronics.
- Identify examples of mechatronic systems that are encountered in real life.
- Identify the components of a typical mechatronic system.

M.Tech (PTPG) III- SEMESTER (CAD/CAM):

3D PRINTING
(Elective – III)

L	T	P	C
4	0	0	4

Course Objectives

This subject provides students with

- An understanding of the various rapid prototyping, rapid tooling, and reverse engineering technologies.
- The knowledge to select appropriate technologies for product development purposes.
- To provide students considering research in this area with an advanced course in which they are exposed to state of the art research that helps them develop novel concepts of their own.

UNIT-I

Introduction: Need - Development of RP system, RP Process chain, Impact of Rapid Prototyping on Product Development, Virtual Prototyping, Classification of RP system, Benefits and Applications

Stereo Lithography System(SLA): Apparatus, Principle, Process parameter, Process details, Data Preparation, Data files and machine details, Advantages, Limitations and Applications.

UNIT II

Fusion Decomposition Modeling: Principle, Process Parameter, Path generation, Applications.

Solid Ground Curing: Principle of Operation, Machine details, Products and Applications,

Laminated Object Manufacturing: Principle of Operation, LOM materials, Process details, Applications.

UNIT –III

Concepts Modelers: Principle, Thermal Jet Printer, Sander's Model Market, 3-D printer, Selective Laser sintering (SLS), Object Quadra system. Laser Engineering Net Shaping (lens)

UNIT –IV

Rapid Tooling: Indirect Rapid tooling- Silicon rubber tooling- Aluminum filled epoxy tooling Spray metal tooling, Cast kriksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.

Software For RP: STL files, Overview of Solid view, Magics, Imics, Magic Communication, etc. Internet based software, Collaboration tools.

UNIT V

RAPID MANUFACTURING PROCESS OPTIMIZATION: Factors influencing accuracy, Data preparation error, Part building error, Error in finishing, Influence of build orientation.

ALLIED PROCESS: Vacuum casting, surface digitizing, Surface generation from point cloud, Surface modification- Data transfer to solid models.

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010
2. Paul F.Jacobs – **"** Stereo lithography and other RP & M Technologies", SME, NY 1996

REFERENCES

1. Flham D.T & Dinjoy S.S – " Rapid Manufacturing " Verlog London 2001
2. Lament wood, "Rapid automated", Indus Press New York.
3. Rafiq Noorani, RapidPrototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006

Course outcomes

Upon completion of the subject, students will be able to

- Apply the basic principles of rapid prototyping (RP), rapid tooling (RT), and reverse engineering (RE) technologies to product development;
- Decipher the limitations of RP, RT, and RE technologies for product development;
- Realize the application of RP, RT, and RE technologies for product development.

M.Tech (PTPG) III- SEMESTER (CAD/CAM):

DISCRETE EVENT SIMULATION
(Elective – III)

L	T	P	C
4	0	0	4

Course objectives

- To provide an insight into how simulation modeling can aid in effective decision-making.
- Mastering of various techniques for discrete event simulation.
- Obtain insight into how fundamental simulation concepts can and may be implemented.
- Be able to plan, carry out, and extract and present results from simulation studies.
- Knowledge of techniques for reduction of variance and reduced simulation times.

UNIT - I

Introduction: History of manufacturing systems, input-output model, Plant configuration, Performance Measures, Computer controlled machines, Material Handling system, Plan layout, Flexible manufacturing systems(FMS), Computer controlled systems.

Modelling automated manufacturing systems, Role of performance modeling, Nature of models, Basic approach to modeling, types of models, requirements of models, analytical Vs simulation models - Need for both, Simulation of an Inventory system

UNIT – II

Simulation Modelling: The nature of simulation, systems models and simulation discrete event simulation, principles of valid simulation modeling, verification of simulation computer programs, general perspectives on validation, A three step approach for developing valid and credible simulation models, Random number generators. Alternative approaches to modeling and coding simulation, Simulation across the internet and web based simulation, Steps in a sound simulation study, Other types of simulation – Continuous simulation, Combined discrete continuous simulation, Monte Carlo Simulation, Advantages, disadvantages and pitfalls of simulation

UNIT - III

Markov Chain Models: Review of basic probability and statistics, Estimation of means and variances, memory less random variables, geometric and exponential random variables, Stochastic process in manufacturing, Discrete time Markov chain models, Continuous time Markov chain models, Semi Markov process in manufacturing.

UNIT – IV

Queuing Models: Queues **,** The M/M/1 Queue, The M/M/m Queue, batch arrival queuing systems, Queues with general distributions, Queues with break downs, Queuing networks, open and closed queuing networks, Queuing networks and blocking, performability analysis

UNIT – V

Simulation Of Manufacturing Systems: Objectives of simulation in manufacturing, Simulation software for manufacturing applications, Modelling system randomness, Sources of randomness, Machine downtimes, Examples – A simulation case study of Metal Parts manufacturing facility

TEXT BOOKS:

1. N . Viswanadham and Y. Narahari, "Performance modeling of Automated Manufacturing Systems", PHI, 1994
2. Averill M. Law and W. David Kelton, "Simulation Modelling and Analysis", McGraw Hill International Editions 1997

REFERENCES:

1. Jerry Banks, John S.Carson, Barry L.Nelson and David M.Nicol, "Discrete – Event system Simulation", Pearson Education International Series in Industrial and Systems Engineering, 200.
2. Fishwick, P.A. (1995) Simulation Model Design and Execution : Building Digital Worlds New Jersey: Prentice Hall Int'l Inc.

Course outcomes

Upon completion of the subject, students will be able to

- Define basic concepts in modeling and simulation (M&S)
- Classify various simulation models and give practical examples for each category
- Construct a model for a given set of data and motivate its validity
- Generate and test random number varieties and apply them to develop simulation models
- Analyze output data produced by a model and test validity of the model
- Explain parallel and distributed simulation methods like Discrete time Markov chain models

M.Tech (PTPG) III- SEMESTER (CAD/CAM):

FLUID POWER SYSTEMS
(Elective – III)

L	T	P	C
4	0	0	4

Course Objectives:

- This course provides specialized instruction in maintaining and troubleshooting Hydraulic and Pneumatic systems.
- Explain the operation of the main elements of an industrial hydraulic and pneumatic system.

UNIT-I

Oil Hydraulic Systems: Hydraulic power generators – selection and specification of pumps, pump characteristics.

Hydraulic Actuators: Hydraulic and rotary actuators – selection, specification and characteristics.

UNIT-II

Control And Regulation Elements: Pressure – direction and flow control valves – relief valves, non return and safety valves- actuation systems.

UNIT-III

Hydraulic Circuits: Reciprocation, quick return, sequencing circuits- accumulator circuits- industrial circuits – press circuits – hydraulic milling machine – grinding, planning, copying, forklift, earth mover circuits – design and selection of components – safety and emergency mandrels.

UNIT-IV

Pneumatic Systems And Circuits: Pneumatic fundamentals- control elements position and pressure sensing – logic circuits- switching circuits- fringe condition modules and their integration – sequential circuits- cascade methods – mapping methods- step counter method – compound circuit design- combination circuit design.

UNIT-V

Installation, Maintenance And Special Circuits: Pneumatic equipments- selection of components- design calculations- applications – fault finding equipments- hydro pneumatic circuits – use of microprocessors for sequencing – PLC- Low cost automation- robotic circuits.

TEXT BOOKS:

1. Andrew Parr, “Hydraulics and Pneumatics”, (HB), Jaico Publishing House, 1999
2. Bolton. W. “Pneumatic and Hydraulic systems”, Butterworth – Heinneman, 1997

REFERENCES:

1. Antony Espossito, "Fluid power with Applications", prentice Hall, 1980
2. Dudleyt A.Pease and John J.Pippenger, "Basic fluid power", Prentice Hall, 1987

Web References:

1. http://www.pneumatics.com
2. http://www.fluidpower.com.tw

Course outcomes:

Upon completion, the student should be able to:

- Define basic fluid power terms and units.
- Identify Hydraulic and Pneumatic graphic symbols.
- Describe fluid power components.
- Calculate basic operations for sizing hydraulic and pneumatic components.
- Perform basic fluid power maintenance procedures.

M.Tech (PTPG) III- SEMESTER (CAD/CAM):

AUTOMATION AND SIMULATION LABORATORY

L	T	P	C
0	0	3	2

Course objectives

- To get the idea about the working principle of Aristo Robot
- To know the working of automation studio software
- To design the hydraulic and pneumatic circuits by using automation studio software
- To design the automated manufacturing systems by using workspace software.

1. Pick and place robot programming by using Aristo Robot.
2. Simulation of a Manufacturing System by using WORKSPACE software.
3. Simulation of automation system by using WORKSPACE software.
4. Simulation of Linear and Rotary actuators by using AUTOMATION STUDIO software.
5. Simulation of hydraulic circuits by using AUTOMATION STUDIO software.
  5.1 Quick return Mechanism circuit.
  5.2 Sequencing circuits like hydraulic milling, grinding, shaping machines.
6. Simulation of Pneumatic circuits by AUTOMATION STUDIO software.
  6.1 Simulation of Cascade Method
  6.2 Simulation of Mapping method
  6.3 Simulation of step counter method

Course outcomes:

Upon successful completion students should be able to:

- Demonstrate the pick and place Aristo Robot.
- Demonstrate the working of workspace software.
- Check the circuit designs whether working properly or not by using Automation studio software.

M.Tech (PTPG) IV- SEMESTER (CAD/CAM):

ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
4	0	0	4

Course Objectives

- The classical optimization techniques are useful in finding the optimum solution for constrained or unconstrained maxima or minima of continuous and differentiable functions.
- These methods lead to a set of nonlinear simultaneous equations that may be difficult to solve. These methods of optimization are discussed**.**

UNIT - I

Linear Programming: Two-phase simplex method, Big-M method, duality, interpretation, applications.

Assignment Problem: Hungarian's algorithm, applications, unbalanced problems, traveling salesman problem.

UNIT - II

Classical Optimization Techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions**.**

Numerical Methods For Optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - III

Genetic Algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

UNIT - IV

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT – V

Introduction To Artificial Neural Networks: Introduction, Artificial Neural Networks, Historical Development of Neural Networks, Biological Neural Networks, Comparison Between Brain and the Computer, Comparison Between Artificial and Biological Neural Networks. Applications of neural networks. Brief Introduction to Multilayer Perceptron networks, Back Propagation Network (BPN). Solving Optimization Problems, Solving Simultaneous Linear Equation, Solving Traveling Salesman Problems using Hopfield Networks.

Text Books:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers

References:

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers
4. Artificial Neural Networks B. Yagna Narayana, PHI
5. Introduction to Artificial Neural Systems - J.M.Zurada, Jaico Publishers, 3rd Edition. Introduction to Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N. Deepa, TMH.

Course Outcomes:

Upon successful completion of this course, the student will be able to understand:

- Basic theoretical principles in optimization;
- Formulation of optimization models;
- Solution methods in optimization;
- Methods of sensitivity analysis and post processing of results
- Applications to a wide range of engineering problems

M.Tech (PTPG) IV- SEMESTER (CAD/CAM):

DESIGN FOR MANUFACTURING

(Elective – IV)

L	T	P	C
4	0	0	4

Course Objectives

- To Design products creatively while applying engineering design principles
- To Apply principles of human factors, ethics and environmental factors in product design
- To Work in groups or individually in their pursuit of innovative product design
- To implement value design for optimum product cost.

UNIT - I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts**.**

UNIT - II

Machining Processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT - III

Metal Casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Metal Joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

UNIT – IV

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations**.**

Extrusion & Sheet Metal Work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT- V

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

TEXT BOOKS:

1. Design for manufacture, John cobert, Adisson Wesley. 1995
2. Product Design For Manufacture And Assembly, 2nd Edition, Geoffrey Boothroyd, Book World Enterprises (2002)

REFERENCES:

1. ASM Hand book Vol.20
2. Engineering Design by George E.Dieter

Course Outcomes

- Ability to apply knowledge of basic science and engineering fundamentals
- Ability to undertake problem identification, formulation and solution
- Understanding of the principles of sustainable design and development
- Understanding of professional and ethical responsibilities and commitment to them

M.Tech (PTPG) IV- SEMESTER (CAD/CAM):

COMPUTATIONAL FLUID DYNAMICS

(Elective – IV)

L	T	P	C
4	0	0	4

Course Objectives*:*

- 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.
- To provide students with the necessary skills to use commercial Computational Fluid Dynamics packages and to carry out research in the area of Computational Fluid Dynamics.

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 tridiagonal matrix algorithm.

UNIT – II

Hyperbolic Equations: Explicit schemes and Von Neumann stability analysis, implicit schemes, 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 state problems, Transient problems.

TEXT BOOK:

1. Computational fluid dynamics/ T. J. C'hung/ Cambridge University press,2002.
2. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.

REFERENCES:

1. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985
2. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
3. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications
4. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
5. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford

Course outcomes:

After completion of this course the student should be:

- Familiar with the differential equations for flow phenomena and numerical methods for their solutions.
- Able to use and develop flow simulation software for the most important classes of flows in engineering and science.
- Able to critically analyze different mathematical models and computational methods for flow simulations.

M.Tech (PTPG) IV- SEMESTER (CAD/CAM):

SUPPLY CHAIN MANAGEMENT

(Elective – IV)

L	T	P	C
4	0	0	4

Course objectives

- The primary objective of this course is to provide the participant with the critical knowledge of logistics and supply chain management and the ability to apply this information in the workplace whether in the management of a firm's related activities or within the scope of the logistics service provider's activities.
- To give participants an understanding that the problems and issues within the respective fields of logistics and supply chain are invariably complex, and require clear reasoning and analysis, in order to derive an appropriate course of action.
- To incorporate and learn the critical elements of Logistics and Supply Chain Management processes.

UNIT-I

Understanding The Supply Chain: What is SCM? Why SCM? The Complexity, Key issues in SCM

Logistics Network: Introduction, Data Collection, Transportation, Ware house Management, Strategic location of ware houses, Demand forecasting, Role of aggregate planning, MRP, ERP, Managing variability, Key features of Network configuration.

UNIT-II

Inventory Management: Concepts of Materials Management, Economic lot size model, Effect of Demand uncertainly, Fixed order costs, Variable lead frames, Inventory under certainly & uncertainty, Risk Management

Value Of Information: The Bullwhip effect, Quantifying Bullwhip effect, Locating Desired Products, Lead time reduction, Conflicting objectives of SCM, Integrating the supply chain.

UNIT-III

Distribution Strategies: Introduction, Centralized vs Decentralized control, Direct shipment, Cross Docking, Push based vs Pull based supply chain.

UNIT-IV

Strategic Alliances: Third party Logistics (3PL), Retailer – supplier relationship issues, requirements, success & failures, Distributor integration Types & issues.

UNIT-V

MIS & SCM: Relational Data Base Management (RDBMS), System Architecture, Communications, And Implementation of ERP, Decision support systems for SCM: Analytical tools, Presentation tools, Smooth production flow Current issues & directing challenges for future, e-Commerce strategies and world class supply chain management.

Text Book:

1. Sunil Chopra, Supply Chain Management: Planning and Operation, Pearson.
2. Burt Dobler and Starling, World Class Supply Management, Tata Mcgraw Hill.

References:

1. Coyle Bondi and Langely, The Management of Business Logistics: A Supply Chain Perspective, Thomson South Western.
2. U Kachru-Logistics and Supply Chain Management –Excel Books.
3. Ashim Raj Singla: Enterprise Resource Planning, Cengage Learning

Course outcomes

- apply logistics and supply chain knowledge, principle and practices in a business of public sector environment to ensure effective and efficient operations of an organization, fulfill a managerial role in logistics and supply chain management within organizations; complete research work to extend supply chain knowledge.
- use and evaluate multiple sources of information expertly to manage and improve logistics and supply chain practices and synthesize information in order to draw evidence based conclusions.
- communicate at an advanced level, using appropriate terminology, with individuals and groups in organizations and within supply chains
- expertly use new and existing technologies relevant to logistics and supply chain management

M.Tech (PTPG) IV- SEMESTER (CAD/CAM):

COMPUTER NUMERICAL CONTROL LABORATORY

L	T	P	C
0	0	3	2

Course objectives

- To get practical knowledge on manual part programming of CNC lathe machine by using G codes and M codes.
- To get practical knowledge on manual part programming of CNC milling and drilling machine by using G codes and M codes.
- To get the practical knowledge on APT language

1. Manual part programming (using G and M codes) in CNC Lathe Machine
1.1 Part programming for linear interpolation, circular interpolation, chamfering and grooving.
1.2 Part programming by using standard canned cycles for turning, facing, taper turning and thread cutting.

2. Manual part programming (using G and M codes) in CNC Milling Machine
2.1 Part programming for linear interpolation, circular interpolation and contour motions.
2.2 Part programming involving canned cycles for drilling peak drilling and boring.

3. *APT* (*Automatically Programmed Tools*) *language in CNC Milling and Lathe machine*

Course outcomes

Upon successful completion students should be able to:

- Use an understanding of General and Machine (G & M) code to generate or edit a program which will operate a CNC Lathe.
- Apply mathematical methods to calculate Cartesian coordinates