TWO YEAR COURSE STRUCTURE

FOR

M.TECH – CAD CAM

w.e.f.

2017-2018 ADMITTED BATCH

R-17 REGULATIONS

DEPARTMENT OF MECHANICALENGINEERING

COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous) PULIVENDULA – 516 390 (A. P.)

Academic regulations for M. Tech. (Regular) program
with effect from academic year 2017-18

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 GATE/PGECET or otherwise specified, whichever is relevant.

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 four semesters and not more than eight semesters.
ii. Students, who fail to fulfill all the academic requirements for the award of the degree within eight 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. 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.

4. COURSE WORK:

The programs are offered on a Semester basis consisting of four Semesters.

i. The candidates shall undergo ***fivetheory*** and ***two laboratory*** courses in ***each semester*** during the first and second semesters. During the third and fourth semesters the candidates pursue the dissertation in the concerned specialization only. The theme of dissertation should conform to the specialization.
ii. There shall be one comprehensive online examinations conducted by the respective department one at the end of 1st year with 60 objective questions for 60 marks on the subjects studied in the respective years of both semesters. The heads of the respective department are given the responsibility of preparing question paper and conducting the online examination by maintaining confidentiality. A student shall acquire Two credit assigned to the online examination only when he/she secure 40% or more marks. In case, if a student fails in comprehensive online examination, he shall re- register by following a similar procedure adopted for the lab examinations.

iii. 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 3rd semester and the *seminar-II* will be in 4th semester.

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

v. Only on 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 concerned supervisor in the prescribed form shall be submitted to the College. Once a student fails to submit the thesis within the stipulated period of four semesters, extension of time up to eight semesters may be permitted by the Principal with recommendation of the College Academic Committee.

vi. The Thesis/Dissertation will be adjudicated by one external examiner from reputed institutions/industry appointed by the competent authority.

vii. 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 as Chairman, the supervisor and the examiner who adjudicated the thesis/ dissertation. The board shall jointly report the candidate's work as:

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

viii. If the report of the viva-voce is not satisfactory, 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 unless the candidate is asked to revise and resubmit the thesis/dissertation. The resubmitted copy shall be evaluated by the same board.

5. EVALUATION:

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

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

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. The two midterm examinations shall be held during the semester, one in the middle of the program and the other one during the last week of instruction. **A student shall answer all three questions in 2 hours of time without seeking any choice**.

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, and the total marks of 60.
b. All the questions have to be answered compulsorily.
c. Each question may consist of one, two or more bits.

ii. For practical subjects, 60 marks shall be for the End Examinations and 40 marks will be for internal evaluation based on the day to day performance. The end semester practical examination shall be conducted by the concerned laboratory teacher and senior expert in the same subject of the department nominated by the Principal.

iii. Comprehensive Online Examination shall be evaluated for 60 marks ad seminar-I and seminar-II shall be evaluated for internal marks of 50 each. There is no external evaluation for them. A candidate has

to secure a minimum of 50% to be declared successful in all the three evaluations. If the candidate fails, he/she has to re-register for Comprehensive Online Examination /seminars. Assessment of these three shall be done by a board consisting of Head of the Department, concerned thesis supervisors, and senior faculty members of the department.

iv. 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.

v. In case the candidate does not secure the minimum aggregate marks as specified in 5 (iv) he/she has to reappear for the semester examination either the supplementary or regular in that subject or repeat the course as and when next offered or do any other specified subject as may be required. *However the candidate is permitted to appear for two courses per semester only*.

6. ATTENDANCE:

A student shall be eligible to appear for end semester examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the 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. **Shortage of Attendance below 65% in aggregate shall in NO case be condoned**.

iii. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

iv. Students whose shortage of attendance is not condoned in any semester are not eligible to take their external Examination of that class and their registration shall stand cancelled.

v. A student will not be promoted to the next semester unless he/she satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester as and when offered next.

vi. A stipulated fee shall be payable towards condonation of shortage of attendance to the institution.

7. Grading System is to be introduced. After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

vii. Table – Conversion into Grades and Grade Points assigned

Academic performance	Letter Grade	Grade points Assigned
≥ 95%	S	10
≥90% - < 95%	A++	9.5
≥ 85% - <90%	A+	9
≥80% - <85%	A	8.5
≥75% - <80%	B++	8
≥70% - <75%	B+	7.5
≥65% - <70%	B	7
≥60% - <65%	C++	6.5
≥55% - <60%	C+	6
≥50% - <55%	C	5.5
≥45% -< 50%	D	5
≥40%- < 45%	E	4.5
Below 40%	F(Fail)	0
Absent	Ab (Absent)	0

i. The following procedure shall be adopted to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA);

ii. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA = \Sigma (C_i \times G_i) / \Sigma C_i$$

Where, Ci is the number of credits of the i^{th} subject and Gi is the grade point scored by the student in the i^{th} course.

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$$

Where 'Si' is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the GPA/CGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.
Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D, E and F.

8. AWARD OF DEGREE AND CLASS:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree he/she shall be placed in one of the following four classes:

Class Awarded	**CGPA Secured**
First Class with Distinction	≥ 7.5
First Class	$\geq 6.5 < 7.5$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 4.0 < 5.5$

(The marks in internal evaluation and external Examination shall be shown separately in the marks memorandum)
Further, CGPA to a maximum of extent of 0.05 shall be added which is just sufficient 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
A candidate shall be eligible for the award of respective degree if he/she satisfies the minimum academic requirements in every subject and secures at least satisfactory report on his/her thesis / dissertation and viva-voce.

9. WITHHOLDING OF RESULTS

The result of a candidate shall be withheld if:

i. He/she has not cleared any dues to the Institution / Hostel.
ii. A case of disciplinary action against him/her is pending disposal.

10. 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 re-admission to the same or equivalent subjects as and when subjects are offered, subject to the conditions mentioned in 5-(iv) and 2-(ii).

11. 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, hers.

iii. There shall be no place for transfer of candidate within the constituent colleges of Jawaharlal Nehru Technological University during the entire course of the programme.

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JNTUA COLLEGE OF ENGINEERING (Autonomous) PULIVENDULA

Coursestructure for M.Tech. CAD CAM(Regular) with effective from 2017-2018

I Year I Semestar

S.NO.	COURSE CODE	SUBJECT NAME	THEORY	LAB	CREDITS
1	17D04101	FINITE ELEMENT METHODS	4		4
2	17D04102	COMPUTATIONAL METHODS	4		4
3	17D04103	GEOMETRIC MODELING	4		4
	17D04104	ADVANCES IN MANUFACTURING TECHNOLOGY	4		4
	17D04105	COMPUTER AIDED PROCESS PLANNING			
4	17D04106	DESIGN AND ANALYSIS OF EXPERIMENTS			
	17D04107	COMPUTATIONAL FLUID DYNAMICS	4		4
	17D04108	PRODUCT ENGINEERING	4		
5	17D04109	COMPUTER INTEGRATED MANUFACTURING	4		
6	17D04110	MODELING LAB		3	2
7	17D04111	FINITE ELEMENT ANALYSIS LAB		3	2
	Total		**20**	**06**	**24**
	Total contact periods/week : 26				
	Total Credits : 24				

I Year II Semestar

S.NO.	COURSE CODE	SUBJECT NAME	THEORY	LAB	CREDITS
1	17D04201	ADVANCED OPTIMIZATION TECHNIQUES	4		4
2	17D04202	ROBOTICS	4		4
3	17D04203	CNC TECHNOLOGY AND PROGRAMMING	4		4
4	17D04204	MECHATRONICS AND MEMS	4		4
	17D04205	ADDITIVE MANUFACTURING			
	17D04206	HYDRAULIC AND PNEUMATIC CIRCUITS			
5	17D04207	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS	4		4
	17D04208	COMPOSITE MATERIALS			
	17D04209	INTERACTIVE COMPUTER GRAPHICS			
6	17D04210	AUTOMATION LAB		3	2
7	17D04211	COMPUTER NUMERICAL CONTROL LAB		3	2
8	17D04212	COMPREHENSIVE ONLINE EXAMINATION			2
	Total		**20**	**06**	**26**
	Total contact periods/week : 26				
	Total Credits **: 26**				

M.Tech (CAD CAM) II Year I Semester

S.NO	Course Code	Subject	Maximum Marks		Total	Min. Marks/ Grades to Pass	Credits
			Internal	External			
1	17D04301	Seminar-I	50	-	50	25	0

M.Tech (CAD CAM) II Year II Semester

S.NO	Course Code	Subject	Maximum Marks		Total	Min. Marks/ Grades to Pass	Credits
			Internal	External			
1	17D04401	Seminar-II	50	-	50	25	0
2	17D04402	**Project Work** Grades : A, B, C, D A - Excellent B - Good C – Satisfactory D - Unsatisfactory	-	-	-	-	18

JNTUA COLLEGE OF ENGINEERING (Autonomous) PULIVENDULA

I M.TECH ISEMESTER

FINITE ELEMENT METHODS (17D04101)

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

Mathematical Model and Approximations: Philosophy and Perspective of FEM, Review of Elasticity, mathematical models for structural problems, Equilibrium of continuum – Differential Formulation, Energy Approach – Integral formulation, Principle of Virtual work – Variational Formulation. Overview of approximate methods for the solution of mathematical methods; Ritz, Rayleigh-Ritz and Galerkin's Method.

Finite Element Formulation: Concept of discretisation, Interpolation, Formulation of Finite element characteristic matrices and vectors, Compatibility, Assembly and boundary considerations.

One-dimensional finite element methods: Bar elements,Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element.

UNIT – II

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 – III

Two dimensional problems: Introduction to 2D elements, 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.

UNIT - IV

FEM in Heat Transfer and Fluid Mechanics problems: Finite element solution for one dimensional heat conduction with convective boundaries. Formulation of element characteristics and simple numerical problems. Finite element applications in one dimensional potential flows; Formulation based on Potential function and stream function.

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.

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 Solidmechanics, heat transfer and Dynamics.*

Derive element matrix equation by different methods by applying basic laws inmechanics and integration by parts.

TEXT BOOKS:

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

REFERENCES:

1. S.Md.Jalaludeen, Finite Element Analysis in Engineering, Anuradha Publications, 2013.
2. J.N. Reddy, An Introduction to the Finite Element Method, McGraw Hill Education Private Limited, 2013.
3. Singiresu S Rao, The Finite Element Method in Engineering, Elsevier, 2012.
4. Zienckiwicz O.C. & R. L. Taylor, Finite Element Method, McGraw-Hill, 1983.
5. K. J. Bathe, Finite element procedures, Prentice-Hall, 1996.
6. Robert.D.Cook, Concepts and applications of Finite Element Analysis, Wiley, 2007.

I M.TECH ISEMESTER

COMPUTATIONAL METHODS(17D04102)

L	T	P	C
4	0	0	4

Course Objectives:

Students will learn

- to solve nonlinear algebraic equations numerically.
- to solve simultaneous linear equations numerically.
- to numerically integrate continuous and discrete functions.
- to numerically solve ordinary and partial 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 –Jacobi's Method,Gauss-Seidal Method, Relaxation methods; Matrix Eigen value Problem. System of non-linear equations –Method of Iteration, Newton-Raphsonmethod

Unit-II

Spline functions: Introduction: Linear Splines, QuadraticSplines.Cubic Splines: Minimizing Property of Cubic Splines,Numerical differentiation by Cubic Splines Method.

UNIT – III

Boundary value problems: Finite Difference Method &Shooting method.

Numerical solutions of partial differential equations: Laplace's equations -Jacobi's Method, Gauss Seidel Method.

UNIT – IV

Parabolic partial differential equations: Explicit method – Crank-Nickelson method – Derivative boundary condition – Stability and convergence criteria.

UNIT – V

Hyperbolic partial differential equations: Solving one dimensional wave equation by finite difference method-stability of numerical method.

TEXT BOOKS:

1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Publication
2. Higher Engineering Mathematics ; B.S.Grewal; Khanna publications

REFERENCES:

1. Steven C.Chapra, Raymond P.Canale "Numerical Methods for Engineers" Tata Mc-Grawhill .
2. Douglas J. Faires, Richard Burden "Numerical Methods" Brooks/Cole publishing company,1998.
3. Numerical Methods for Scientific and Engineering Computation; M.K.Jain, S.R.K.Iyengar, R.K.jain

Course Outcomes:

After completion of this course the student should:

- Understand the concept and steps of Numerical methods, solution and implementation.
- Solve the boundary value problems numerically.
- be able to identify, formulate and solve engineering problems.

I M.TECH ISEMESTER

GEOMETRIC MODELING (17D04103)

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, Graphic construction and interpretation, composite pc curves.

Unit - III

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

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

Unit – IV

Surfaces: Bicubic surfaces, Coon's surfaces, Bezier surfaces, B-Spline surfaces, surfaces of revolutions, Sweep surfaces, ruled surfaces, tabulated cylinder, bilinear surfaces, triangular patches, sculptured surface and rational parametric surface.

Unit – V

Solids: Tricubic solid, Algebraic and geometric form.

Solid modeling concepts: Wire frames, Boundary representation, Half space modeling, spatial cell, Constructive Solid Geometry (CSG), Analytical Solid Modelling (ASM).

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.

TEXT BOOKS:

1. Geometric Modeling by Micheal E. Mortenson, McGraw Hill Publishers.
2. CAD/CAM by Ibrahim Zeid, Tata McGraw Hill.
3. 3rd edition CAD/CAM principles and applications by P. N. Rao, McGraw Hill Publishers.

REFERENCES:

1. Elements of Computer Graphics by Roger & Adams, Tata McGraw Hill.
2. Computer Aided Design and Manufacturing, K.Lalit Narayan, K.Mallikarjuna Rao, MMM Sarcar, PHI Publishers

I M.TECH ISEMESTER

ADVANCES IN MANUFACTURING TECHNOLOGY (17D04104)

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.

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

TEXT BOOKS:

1. Advanced Machining Processes - V.K.Jain, Allied Publishers Private Limited.
2. Fundamentals of Modern Manufacturing- Mikell P. Groover, John Wiley & Sons Publishers
3. Modern Machining Process- P.C Pandey and H.S Shan, Tata McGraw - Hill Education (1980)
4. Unconventional Machining Processes - T.Jagadeesha, I.K Publishers, 2016

REFERENCES:

1.Manufacturing Technology - P.N.Rao, McGraw Hill Education Private Limited
2.Manufacturing Science - Amitabha Ghosh, Asok Kumar Mallik, East West press
3.Welding Technology - R.S, Parmar, Khanna Publishers (2013)

I M.TECH ISEMESTER

COMPUTER AIDED PROCESS PLANNING (17D04105)

L	T	P	C
4	0	0	4

Course Objective

• To provide the student with an understanding of the importance of process planning role in manufacturing and the application of Computer Aided Process Planning tool in the present manufacturing scenario.

UNIT IIntroduction

The Place of Process Planning in the Manufacturing cycle- Process planning and production planning – Process planning and Concurrent Engineering, CAPP.

UNIT II Part Design Representation

Design Drafting – Dimensioning – Conventional Toloerencing – Geometric Toloerencing- CAD – input/output devices – Topology – Geometric transformation – Perspective transformation – Data Structure – Geometric modeling for process planning –Group technology coding – The OPITZ system – The MICLASS System.

UNIT III Process Engineering and Process Planning

Experienced based planning – Decision table and Decision trees – Process capability analysis – Process planning – Variant process planning – Generative approach – Forward and backward planning, Input format, A1

UNIT IV Computer Aided Process Planning Systems

Logical Design of process planning – Implementation considerations- Manufacturing system components, Production Volume, No. of production families- CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

UNIT VAn Integrated Process Planning Systems

Totally integrated process planning systems – An Overview – Modulus structure – Data structure – Operation – Report Generation, Expert process planning.

Course outcomes

Upon completion of this course, the student shall be able to:

- Have a sound knowledge in process planning

Handle computer aided process planning tool

Textbooks

1. Gideon Halevi and Roland D.Weill, “Principle of process planning”, Alogical approach, chapman & Hall, 1995.
2. C.Elanchezhian and T.SunderSelwin, “Computer aided manufacturing” university science press. 2014.

References.

1.Tien-Chien-Chang, Richard A.Wysk, “ An Introduction to automated process planning systems”, Prentice Hall 1985.
2. Chang.T.C.,”An Expert Process Planning System”, Prentice Hall, 1985.
3. Nanua Singh,” Systems Approach to Computer Integrated Design and Manufacturing”, John Wiley & Sons, 1996.
4. Rao, “ Computer Aided Manufacturing”, Tata McGraw Hill Publishing Co., 2000.

I M.TECH ISEMESTER

DESIGN AND ANALYSIS OF EXPERIMENTS (17D04106)

L	T	P	C
4	0	0	4

Course Objectives:

- *To know the importance of quality in manufacturing industries*
- *To understand the steps involved in Design of Experiments and ANOVA*
- *To know how to apply ANOVA & DOE to develop a new manufacturing process.*
- *To know about the different standardization methods for manufacturing.*
- *To Understand and apply the principles of math, science, and engineering in design and manufacturing related activities.*

UNIT-I

Quality value and Engineering: An overall quality system, Quality Engineering in Production Design, Loss function and quality level**:** Derivation and use of Quadratile Loss Function, Economic Consequences of tightening tolerances as a means to improve quality, Evaluations

UNIT-II

Tolerance Design and Tolerancing: Introduction to Tolerances, Types of Tolerances (N-type-, S-type and L-type), 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, Introduction to Tolerance Design, tolerance design using the loss function, identification of tolerance design factors.

UNIT-III

Design of Experiments: Introduction, Task aids and Responsibilities for DOE process steps, DOE process steps description.

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, Conducting and Analyzing an experiment.

Interpolation of experimental results: Interpretation methods, Percent Contribution, Estimating the Mean.

UNIT-V

ISO-9000 Quality system, BDRE,6-sigma, Taguchi Methods, Bench Marking, Quality Circles-Brain Storming-Fishbone Diagram-Problem Analysis.

Course Outcomes:

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

- *Understanding of time and motion study, work sampling, and process flow charting*
- *Critically observe manufacturing operations.*
- *Produce short technical reports individually and in teams.*
- *Contribute to the profitable growth of manufacturing businesses.*
- *Maintain high standards of professional and ethical responsibility.*
- *To design and conduct experiments, as well as to analyze and interpret data.*

To use the techniques, skills, and modern engineering tools necessary for engineering.

TEXT BOOKS:

1. Taguchi techniques for quality engineering/Philip J.Ross / McGraw Hill Intl. 2nd Edition, 1995.
2. Montgomery DC, Design and Analysis of Experiments, 7th Edition, John Wiley & Sons, NY, 2008.

REFERENCES:

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

3. Probability And StatisticsDr.B.Krishna Gandhi, Dr. T.K.V. Iyengar, S.Chand Publications.

I M.TECH ISEMESTER

COMPUTATIONAL FLUID DYNAMICS (17D04107)

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.

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.

TEXT BOOK:

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

REFERENCES:

1. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985
2. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hemashava Publishers corporation&McGraw 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.

I M.TECH ISEMESTER

PRODUCT ENGINEERING (17D04108)

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 factorsin 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 using Ashby charts - 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 simulation in casting design-product design rules for sand casting.

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design recommendations for weld strength, general design guidelines for minimizing weld distortion - pre and post treatment of welds - effects of residual stresses in weld joints - design of brazed joints.

UNIT – IV

Forging: Design factors for forging – parting lines of dies – general design principles for open die and closed die forging – general design recommendations.

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

UNIT- V

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

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

TEXT BOOKS:

1. Design for manufacturability Handbook, Bralla, Tata McGraw Hill Education. 1998
2. Engineering Design, George E Dieter, Linda C Schmidt, McGraw Hill Education.
3. Production Engineering, P.C.Sharma, S.Chand& Company Ltd.

REFERENCES:

1. Product Design and Manufacturing, A.K.Chitale&R.C.Gupta, PHI Learning
2. Manufacturing Technology (Volume – 1), P.N.Rao, McGraw Hill Education
3. Manufacturing Engineering and Technology, SeropeKalpakjian& Steven R. Schmid, Pearson India

I M.TECH ISEMESTER

COMPUTER INTEGRATED MANUFACTURING (17D04109)

L	T	P	C
4	0	0	4

Course Objectives:

- *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

Manufacturing Automation: Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Strategies-The USA Principle, Ten Strategies for Automation and Process Improvement, Automation Migration Strategy.

Automated Flow lines: System Configurations, Workpart Transfer Mechanisms, Storage Buffers, Control of Production Line, Analysis of Transfer Lines-Transfer Lines with No Internal Parts Storage, Transfer Lines with Internal Storage Buffers.

UNIT-II

Manual Assembly Lines: Assembly Workstations, Work Transport Systems, Line Pacing, Coping With Product Variety, Analysis of Single Model Assembly Lines-Repositioning Losses, The Line Balancing Problem, Line Balancing Algorithms-Largest Candidate Rule, Kilbridge and Wester Method, Ranked Positional Weights Method.

Automated Assembly Systems: System Configurations, Parts Delivery at Workstations, Applications, Quantitative Analysis of Assembly Systems- Parts Delivery System at Workstations, Multi-station Assembly machines, Single Station Assembly Machines, Partial Automation.

UNIT-III

Automatic Material Handling and Storage systems: Design Considerations in Material Handling, Material Transport Equipment-Industrial Trucks, Automated Guided Vehicles, Monorails and Other Rail-Guided Vehicles, Conveyors, Cranes and Hoists, Analysis of Vehicle Based Systems, Conveyor Analysis. Automated Storage/Retrieval Systems, Carousel Storage Systems, Engineering Analysis of AS/RS and Carousel Systems.

Automated Inspection systems: Overview of Automated Identification Methods, Bar Code Technology, Radio Frequency Identification, Other AIDC Technologies-Mangnetic Stripes, Optical Character Recognition, and Machine Vision.

UNIT-IV

Cellular Manufacturing Systems: Part Families, Parts Classification and Coding, Features of Parts Classification and Coding Systems, Opitz of Parts Classification and Coding Systems, Production Flow Analysis, Composite Part Concept, Machine Cell Design, Applications Of Group Technology, Quantitative analysis of Cellular Manufacturing, Grouping of parts and Machines by Rank Order Clustering, Arranging Machines in a GT Cell.

Computer Aided Process Planning: Retrieval CAPP Systems, Generative CAPP Systems, Feature Identification-Algorithms, Graph Based Approach, Attribute Adjacency Graph, Benefits of CAPP.

UNIT-V

Flexible Manufacturing Systems: Flexibility, Types Of FMS-A Dedicated FMS, A Random Order FMS, FMS Components-Workstations, Material Handling and Storage Systems, Computer Control System, Human Recourses, FMS Applications and Benefits

Computer Integrated Manufacturing: The Scope of CAD/CAM and CIM, Computerized elements of a CIM System, Components of CIM, Database for CIM, Planning , Scheduling and Analysis of CIM Systems.

Course Outcomes:

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

- *Understand the effect of manufacturing automation strategies and derive production metrics.*
- *Analyze automated flow lines and assembly systems, and balance the line.*
- *Design automated material handling and storage systems for a typical production system.*
- *Design a manufacturing cell and cellular manufacturing system.*

Develop CAPP systems for rotational and prismatic parts.

Text Books:

1. Mikell P Groover, *Automation, production Systems and Computer Integrated Manufacturing,* 3rd Edition, Prentice Hall Inc., New Delhi, 2007.
2. Andrew Kusiak, *Intelligent Manufacturing System,* Prentice Hall Inc., New Jersey, 1992.

REFERENCE:

1. Davis Bedworth, " Computer Integrated Design and Manufacturing", TMH, New Delhi,
2. Nanua Singh, *System Approach to Computer Integrated Manufacturing,* Wiley & Sons Inc., 1996.
3. YoremKoren, " Computer Integrated Manufacturing", McGraw Hill,1983.
4. PN RAO , " CAD/CAM", (PHI)
5. CSP Rao – "CAD/CAM", Sciethech publication, 2008.

I M.TECH ISEMESTER

MODELLING LAB (17D04110)

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) Cubic Splines
b) Bezier curves
c) B-Splines.

2. Generation of the following surfaces using "C" language

a) Bezier surfaces
b) B-Spline surfaces

3. Typical tasks of Modeling using PRO/E, IDEAS, CATIA solid modeling packages

a) Sketcher Module
b) Part Module
c) Assembly Module
d) Drafting Module
e) Surface Modelling

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.*

I M.TECH ISEMESTER

FINITE ELEMENT ANALYSIS LAB (17D04111)

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.*

Finite Element Analysis using ANSYS 14.5 Package for different structures the discretization can be done 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 and Fluid flow 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
   d. Determination of velocity of a fluid and volumetric flow rates for 1-D Fluid flow
   e. Determination of velocity of a fluid and volumetric flow rates for 2-D Fluid flow
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
5. FEM through MAT LAB
   a. Introduction to MAT LAB
   b. Analysis of 1-dimesional & 2D dimensional truss.
   c. Analysis of 1-dimesional & 2D dimensional beam.
   d. Analysis of 1-dimesional & 2D dimensional heat conduction.

Course outcomes

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

I M.TECH IISEMESTER

ADVANCED OPTIMIZATION TECHNIQUES (17D04201)

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

Single variable optimization: Optimality Criteria, Bracketing Methods, Region Elimination Methods, Point Elimination Method, Gradient Based Methods with and without constraints,

UNIT - III

Multi Variable Optimization: Optimality Criteria, Unidirectional Search, Direct Search Methods, Gradient Based Methods.

Constrained Optimization: Method of Lagrangian multipliers, Kuch – Tucker Conditions, Transformation methods, Sensitivity Analysis, Direct Search for Constrained Minimization, Linearized Search Techniques, Feasible Direction Method, Generalized Reduced Gradient Method, Gradient Projection Method.

UNIT - IV

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 – V

Artificial Neural Networks: Neuron, Nerve Structure and synapse, Artificial Neuron and its model, activation functions, Neural Network architecture: single layer and multilayer feed forward networks, recurrent networks. Back propagation algorithm, factors affecting back propagation training, applications.

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

Text Books:

1. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
2. Engineering Optimization – S.S.Rao, New Age Publishers
3. Artificial Neural Networks B. YagnaNarayana, PHI

References:

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

I M.TECH IISEMESTER

ROBOTICS (17D04202)

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, history of robotics, definition and classification of robots, control systems and dynamic performance, robot characteristics and precision of motion, 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, combine transformations.

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: Linear velocity of a rigid body, Relationship between transformation, mapping velocity vector, velocity propagation along links, manipulator Jacobian, Jocobian inverse, Jacobian singularities.

UNIT – III

Dynamic Modeling: Lagrangian mechanics, two degree of freedom manipulator, Lagrangian - Euler formulation, Newton - Euler formulation, comparison of Lagrangian - Euler and Newton - Euler formulations.

UNIT – IV

Robot sensors: Introduction, sensor characteristics, Sensors in robotics, tactile sensors, proximity sensors and range sensors, miscellaneous sensors and sensor- based systems, uses of sensors in robotics.

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

UNIT – V

Robot programming: Methods of robot programming, Lead through programming methods, a robotic program as a path in space, motion interpolation, WAIT, SIGNAL, and DELAY commands, Branching, capabilities and limitations of lead through method.

Robot Languages: The textual robot languages, generations of robot program languages, Robot languages structure, constants, variables and other data objects, motion commands, end effecter and sensor commands, Computations and operations, program control and subroutines, communications and data processing, monitor mode commands, VAL-II.

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.

TEXT BOOKS:

1. Industrial Robotics – Mikell P. Grooverand Mitchell Weiss, Roger N. Nagel, Nicholas G.Odrey – McGraw Hill, 1986.
2. Robotics and control - R K Mittal and I J nagrath,TataMcGraw Hill 2004.

REFERENCES:

1. Robotic Engineering - integrated approach by Richard d Klafter- London: Prentice-Hall- 1989.
2. Introduction to Robotics – Analysis, System, Applications by Saeed B. Niku, PHI Publications
3. Fundamentals of Robotics: Analysis and control, Robert J. Schilling, Prentice Hall, 1990.
4. Robotics for Engineers- yoramkoren, McGraw-Hill, 1985.
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. McGraw Hill, 1987.

I M.TECH IISEMESTER

CNC TECHNOLOGY & PROGRAMMING (17D04203)

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, Classification of CNC, DNC and Machining centers and turning 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), Tool presetting.

UNIT – III

Electro-magnetic analogue position transducers: Principle, advantages, characteristics, 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.

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

Text Books:

1. Computer Numerical Control Machines – Dr.RadhaKrishnanan, New Central Book Agency
2. Computer Aided Manufacturing, C.Elanchezhian and T.Sundar Selwyn, University Science Press.
3. Computer Control of Manufacturing systems -Y.Koren – Khanna publications

References:

1 Computer Numerical Control Machines – Hans B.Keif and T. Frederick Waters Macmillan/McGraw Hill
2 CNC Machining technology – Smith &Graham.T Springer – Verlag
3 CAD/CAM – CSP Rao - Sciethech publications, 2008.
4 NC machine programming and software design - Chao-HWA Chang Michel A Melkanoff, Prentice Hall.
5 Computer Numerical Machine tools - G.E. Thyer, NEWNES
6 CAD/CAM – PN Rao, Tata McGraw Hill.
7 Introduction to CNC – James V.Valentine&Josophgoldenberg

I M.TECH IISEMESTER

MECHATRONICS AND MEMS (17D04204)

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, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

UNIT – II

Sensors: Static characteristics of sensors, Displacement, Position and Proximity Sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

UNIT – III

Actuators: Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys, Selection criteria for actuators.

UNIT – IV

Microprocessors, Microcontrollers and Programmable Logic Controllers: Architecture of of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of -.

UNIT – V

Micro Electro Mechanical Systems (MEMS): History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, Applications: Lab on chip.

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.

Text books:

1. Mechatronics, W.Bolton, Pearson Education
2. Mechatronic System Design, Devadas Shetty and Richard A Kolk, Cengage learning
3. Mechatronics an integrated approach, Clarence W. de Silva, CRC Press
4. Micro Electro Mechanical Systems Design, James J Allen, CRC Press Taylor & Francis group
5. Mechatronics, Ganesh S Hedge, Jones and Bartlett Publishers

I M.TECH IISEMESTER

ADDITIVE MANUFACTURING (17D04205)

L	T	P	C
4	0	0	4

OBJECTIVE: *To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.*

UNIT I

INTRODUCTION: Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits-Applications.

UNIT II

REVERSE ENGINEERING AND CAD MODELING: Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modelling techniques: Wire frame, surface and solid modelling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT III

LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS: Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, is recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modelling (FDM): Principle, details of processes,process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT IV

POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

UNIT V

OTHER ADDITIVE MANUFACTURING SYSTEMS: Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

Course Outcome:

On completion of this course, they will learn about a variety of Additive Manufacturing (AM) technologies, their potential to support design and manufacturing, case studies relevant to mass customized manufacturing, and some of the important research challenges associated with AM and its data processing tools.

TEXT BOOKS:

1. Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.

2. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, second edition, World Scientific Publishers, 2010.

REFERENCES:

1. Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003.

2. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2011.

3. Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.

4. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.

I M.TECH IISEMESTER

HYDRAULIC AND PNEUMATIC CIRCUITS (17D04206)

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.

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.

Text Books

1. R.Sreenivasan "Hydraulic & Pneumatic Controls", McGraw Hill Education (2008).
2. Majumdar "Oil hydraulic systems: Principles and maintenance" TATA McGraw Hill.
3. Bolton. W. “Pneumatic and Hydraulic systems”, Butterworth – Heinneman, 1997.

Reference Books

1. Antony Espossito, “Fluid power with Applications”, prentice Hall, 1980.
2. DudleytA.Pease and John J.Pippenger, “Basic fluid power”, Prentice Hall, 1987.
3. Andrew Parr, “Hydraulics and Pneumatics”, (HB), Jaico Publishing House, 1999.

Web References:

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

I M.TECH IISEMESTER

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS(17D04207)

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.*

UNIT-I

Artificial Intelligence (A.I.): Problem Space, Problem solving, State space, Algorithm's performance and complexity, Search Algorithms, Depth first search method, Breadth first search methods their comparison, A*, AO*, Branch and Bound search techniques, p type, Np complete and Np Hard problems.

Knowledge Acquisition and Representation: Manual approach to knowledge Acquisition, Machine Learning approach to Knowledge Acquisition, Semantic nets, Inheritance in Semantic nets, Manipulating monotonic and default inheritance in Semantic nets, Frames, Inheritance in Tangled Frames, Petri nets, Conceptual Dependency, Scripts.

UNIT-II

Learning Systems: Learning concepts, a simple Learning Algorithm, Nearest Neighbors Algorithm, supervised Learning and unsupervised Learning, Reinforcement Learning, Learning by Inductive Logic Programming, Computational Leaning Theory.

Expert systems, Expert system applications for CIM: Introduction to Expert Systems (ES), Personnel Involved in Expert System, Criteria for building an expert system, Architecture of an Expert System, Components of Expert Systems, Inference engines control Strategy, Building an Expert System, Applications in Capacity planning, Facility Location, Inventory Control, Scheduling.

UNIT-III

Knowledge based systems (KBS): Basic Knowledge based system Architecture, Active Knowledge based systems, Knowledge Development Expert systems, Using Knowledge Distribution in Engineering, A Universal representation Paradigm for Knowledge Base Structuring Methods.

UNIT-IV

Artificial Neural Networks: Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Back propagation algorithm, factors affecting back propagation training, applications.

Fuzzy Logic And Fuzzy Sets: Fuzzy set Theory, Interval arithmetic, Operations on Fuzzy Sets, Fuzzy Logic Theory, Classical Logic Theory, Fuzzy System Modeling, Fuzzy Control Systems, Adaptive fuzzy Control.

UNIT-V

Applications of Fuzzy Systems and ANNS for selection of Robots: Health Monitoring Fuzzy Diagnostic Systems, Fuzzy Controller for Robotic Manipulator, Fuzzy Control for Servo Mechanic Systems, ANN for Robotic path Planning, Fault detection and isolation in Robotics.

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.

TEXT BOOKS:

1. Andrew Kusiak, Intelligent Manufacturing Systems, Prentice Hall Publications.2005
2. S.M. and Kulliknowske, "Designing Expert System", Weis, London Champion Hull 1984
3. Simons, G. L., Introducing Artificial Intelligence, NCC Pub., 1990.

REFERENCES:

1. Andrew Kusiak, Computational Intelligence in Design and Manufacturing, John Wiley and Sons, 2000.
2. Elaine Rich & Kevin Knight, " Artificial Intelligence" , M/H 1983
3. WendryB.Ranch, "Artificial Intelligence in Business", Science & Industry – Vol -II application, Ph 1985.
4. Waterman, D.A., Addison, " A Guide to Expert System" – Wesley inc. 1986.
5. Hayes, Roth, Waterman, "Building expert system" D.A (ed), AW 1983.

I M.TECH IISEMESTER

COMPOSITE MATERIALS (17D04208)

L	T	P	C
4	0	0	4

Course objectives

- *Introduce modern composite materials and their applications to students.*
- *Build proper background for stress and strength analysis in the design of composite materials and structures.*

UNIT I

INTRODUCTION TO COMPOSITES

Fundamentals of composites – Definition – classification of composites materials – based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications

UNIT II

POLYMER MATRIX COMPOSITES

Polymers - Polymer matrix materials – PMC processes - hand layup processes – spray up processes – resin transfer moulding – Pultrusion – Filament winding – Auto clave based methods - Injection moulding – sheet moulding compound – properties and applications of PMCs.

UNIT III

METAL MATRIX COMPOSITES

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – Insitu processes. Properties and applications of MMCs.

UNIT IV

CERAMIC MATRIX COMPOSITES

Ceramic matrix materials – properties – processing of CMCs –Sintering - Hot pressing – Infiltration – Lanxide process – Insitu chemical reaction techniques – solgel polymer pyrolsis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing(HIPing). Properties and Applications of CCMs.

UNIT V

ADVANCES IN COMPOSITES

Carbon /carbon composites: Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications.

Biodegradable composites: Biodegradability, introduction of biocomposites, classification, processing of biocomposites, applications of biocomposites - Mechanical, Biomedical, automobile Engineering.

Course Outcomes:

After completion of the course student can be able to:

- *Understanding of types, manufacturing processes, and applications of composite materials.*

Understanding the theory behind Biocomposites.

TEXT BOOKS

1. “Composite materials”, Chawla K.K., Springer – Verlag, Second Edition, 1998.
2. “Composite Materials: Engineering and Science”, Mathews F.L. and Rawlings R.D., Chapman and Hall, London, England, 1st edition, 1994.

REFERENCES

1. “Composite Materials”., H K Shivanand, B V BabuKiran, ASIAN BOOKS, 2011
2. “Fundamentals of Composite Manufacturing”, A.B. Strong, SME, 1989.
3. “Composite materials”, S.C. Sharma, Narosa Publications, 2000.
4. “Hand Book of Bioplastics&Biocomposites for Engineering applications”, Maureen Mitton, John Wiley publications.

I M.TECH IISEMESTER

INTERACTIVE COMPUTER GRAPHICS (17D04209)

L	T	P	C
4	0	0	4

Course objectives

- *Know and be able to use the underlying algorithms, mathematical concepts, supporting computer graphics. These include but are not limited to: Composite 3D homogeneous matrices for translation, rotation, and scaling transformations. Plane, surface normals, cross and dot products. Hidden surface detection / removal. Scene graphs, display lists.*
- *Know and be able to select among models for lighting/shading: Color, ambient light; distant and light with sources; Phong reflection model; and shading (flat, smooth, Gourand, Phong).*

UNIT - I

Introduction to computer graphics: Color CRT raster scan monitors, plasma display & liquid crystal display monitors, computer input devices, hard copy devices.

UNIT - II

Raster scan graphics: Line drawing algorithms, DDA &Bresenham's algorithms, circle generating algorithms, DDA, Bresenham's& midpoint circle algorithm and related problems, general function rasterization, displaying lines, characters and polygons.

UNIT - III

Filling algorithms: polygon filling, filled area primitives, Scan-Line polygon fill algorithm, edge fill algorithm, seed fill algorithm, fundamentals of antialiasing and half toning.

UNIT - III

Line clipping: Simple visibility algorithm, Cohen-Sutherland line clipping algorithm, midpoint sub division algorithm.

Polygon clipping: polygon clipping, Weiler– Atherton polygon clipping, Sutherland – Hodgeman algorithm, character clipping.

UNIT - IV

Transformations: Cartesian and homogeneous coordinate systems two dimensional and three dimensional transformations – scaling, rotation, Shearing, Zooming, viewing transformation, reflection, rotation about an axis & arbitrary axis, concatenation.

UNIT - V

Rendering: Hidden line removal algorithms, surface removal algorithms, back face removal algorithm, painters, Warnock, Z-buffer algorithm.

Shading algorithms: Constant intensity algorithm, Gouraud shading algorithm, Phong shading algorithm, Fast Phong shading algorithm Comparison of shading algorithms

COURSE OUTCOMES

Upon completing this course,

- *Students will demonstrate an understanding of contemporary graphics hardware.*
- *Students will create interactive graphics applications in C++ using one or more graphics application programming interfaces.*
- *Students will write program functions to implement graphics primitives.*
- *Students will write programs that demonstrate geometrical transformations.*

Students will demonstrate an understanding of the use of object hierarchy in graphics applications.

TEXT BOOKS:

1. Computer Graphics-Donald Hearn & M.P. Bakers.
2. Procedural elements for computer graphics-D. F. Rogers, Tata McGraw-Hill.

REFERENCES:

1. Interactive computer graphics – New mann&Sprowl
2. Computer graphics-Harrington.
3. CAD/CAM theory and practice, Ibrahim Zeid, 2nd edition, Tata McGraw-Hill.

AUTOMATION LAB (17D04210)

L	T	P	C
0	0	3	2

COURSE OBJECTIVES

- *To train the students in writing programs for robot movements*
- *To train the students in handling FMS cell for different sequences*
- *To design the hydraulic and pneumatic circuits by using automation studio software*
- *To design the automated manufacturing systems by using workspace software.*

1. **Aristo XT Six axis Robot**
   a. Introduction to Robot programming
   b.Robot programming exercises (Point-to-Point and continuous path task)
2. **WORKSPACE software.**
   a. Simulation of a manufacturing system for increasing production rate.
   b. Simulation of a simple automation system.
3. **AUTOMATION STUDIO software.**

I.Hydraulic Circuits

a. Introduction to Automation studio & its control
b. Draw & Simulate the Hydraulic circuit for series & parallel cylinders connection
c. Draw & Simulate Meter-in, Meter-out and hydraulic press and clamping.
d. Sequencing circuits in hydraulics.
e. Synchronizing circuits in hydraulics.

II. Pneumatic circuits

a. Sequencing circuits in Pneumatics.
b. Synchronizing circuits in Pneumatics.
c. Design and Simulation of simple pneumatic circuit by using Cascade Method.
d. Design and Simulation of simple pneumatic circuit by using step counter method

4. Additive manufacturing machine

a. Introduction to Additive manufacturingMachine.
b. Design and fabrication of simple symmetrical and unsymmetrical components.

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.*

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CNC LAB (17D04211)

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 facing, turning, 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*