ACADEMIC REGULATIONS
COURSE STRUCTURE AND SYLLABI

FOR

M.TECH.
CAD / CAM
(MECHANICAL ENGINEERING)

2012-2013

COLLEGE OF ENGINEERING

GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING
(AUTONOMOUS)
ACCREDITED BY **NAAC** WITH **A** GRADE WITH A **CGPA** OF **3.47/4.00**
AFFILIATED TO JNTU KAKINADA
MADHURAWADA, VISAKHAPATNAM 530048

Vision

To evolve into and sustain as a Centre of Excellence in Technological Education and Research with a holistic approach.

Mission

To produce high quality engineering graduates with the requisite theoretical and practical knowledge and social awareness to be able to contribute effectively to the progress of the society through their chosen field of endeavor.

To undertake Research & Development, and extension activities in the fields of Science and Engineering in areas of relevance for immediate application as well as for strengthening or establishing fundamental knowledge.

F O R E W O R D

It is three years since the G.V.P College of Engineering has become Autonomous with the appreciation and support of erstwhile JNTU and the fast growing new JNTU-K. The college is progressing well with its programmes and procedures drawing more and more accolades from its sister autonomous colleges and higher authorities. The student community, also could adjust well to the new system without any acrimony.

The College is enriched with the experience of running the Post-graduate programmes under Autonomous stream. It is a moment of pride and achievement that the first Autonomous batch of M.Tech in some branches left the college to the satisfaction of all concerned including firms visited the campus for placements.

Another larger than canvas picture is foreseen for the programmes wherein the college is getting the funds through TEQIP – II for up-scaling the PG education and research under sub- component 1.2. In this connection two new PG Programmes have been introduced in Mechanical, Electrical Engineering.

New set of Boards of Studies, Academic council and Governing Body has further strengthened our hands by endorsing the practices and suggested recommendations.
The encouragement given by the affiliating JNTU-K has left no task insurmountable.

Principal

MEMBERS ON THE BOARD OF STUDIES IN MECHANICAL ENGINEERING

- Head of the Department.

- Sri V. Damodar Naidu, Sujana Towers Ltd., Hyderabad.
- Prof. M.M.M. Sarcar, Dept. of Mechanical Engg., A.U.
- Prof. N. Siva Prasad, Department of Mechanical Engg., IIT-M, Chennai.
- Prof. K.R. Srinivas, Engineering Mechanics Unit, JNCASR, Bangalore.
- Prof. P. Bangaru Babu, Professor in Mechanical Engg., NIT Warangal.
- Sri M. Prasanna Kumar, DGM, O&M, NTPC Simhadri, Parawada.
- Sri P. Srikanth, Project Manager, Parabola Software Development Private Ltd., Visakhapatnam.

All faculty of the department.

ACADEMIC REGULATIONS

(Effective for the students admitted into
first year from the academic year 2012-2013)

The M.Tech Degree of JNTU-KAKINADA shall be recommended to be conferred on candidates who are admitted to the program and fulfill all the requirements for the award of the Degree.

1.0 ELGIBILITY FOR ADMISSION:

Admission to the above program shall be made subject to the eligibility, qualifications and specialization as per the guidelines prescribed by the APSCHE and AICTE from time to time.

2.0 AWARD OF M.TECH. DEGREE:

a. A student shall be declared eligible for the award of the M.Tech. degree, if he pursues a course of study and completes it successfully for not less than two academic years and not more than four academic years.
b. A student, who fails to fulfill all the academic requirements for the award of the Degree within four academic years from the year of his admission, shall forfeit his seat in M.Tech. Course.
c. The duration of each semester will normally be 20 weeks with 5 days a week. A working day shall have 7 periods each of 50minutes.

3.0 COURSES OF STUDY:

M.TECH. COURSES	INTAKE
Chemical Engineering	18
Computer Science and Engineering	18
CAD/CAM	18
Computer Aided Analysis And Design	18
Infrastructural Engineering and Management	18
Structural Engineering	18
Power System Control and Automation	18
Power Electronics and Drives	18
Embedded Systems & VLSI Design	18
Communications & Signal Processing	18
Software Engineering	18
Power Electronics & Drives	18
Computer Aided Analysis And Design (CAAD)	18

4.0 ATTENDANCE:

The attendance shall be considered subject wise.

a. A candidate shall be deemed to have eligibility to write end semester examinations in a subject if he has put in at least 75% of attendance in that subject.

b. Shortage of attendance up to 10% in any subject (i.e. 65% and above and below 75%) may be condoned by a Committee on genuine and valid reasons on representation by the candidate with supporting evidence.

c. Shortage of attendance below 65% shall in no case be condoned.

d. A student who gets less than 65% attendance in a maximum of two subjects in any semester shall not be permitted to take the end- semester examination in which he/she falls short. His/her registration for those subjects will be treated as cancelled. The

student should re-register and repeat those subjects as and when offered next.

e. If a student gets less than 65% attendance in more than two subjects in any semester he/she shall be detained and has to repeat the entire semester.
d. A stipulated fee shall be payable towards condonation of shortage of attendance.

5.0 EVALUATION:

The Performance of the candidate in each semester shall be evaluated subject-wise, with 100 marks for each theory subject and 100 marks for each practical, on the basis of Internal Evaluation and End Semester Examination.

a. 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.
b. For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination, 40 marks shall be awarded based on the Internal Evaluation. One part of the internal evaluation shall be made based on the average of the marks secured in the two Mid–Term Examinations of 30 each conducted one in the middle of the Semester and the other immediately after the completion of instruction. Each mid-term examination shall be conducted for a duration of 120 minutes with 4 questions without any choice. The remaining 10 marks are awarded through an average of continuous evaluation of assignments / seminars / any other method, as notified by the

teacher at the beginning of the semester.

c. For Practical subjects, 50 marks shall be awarded based on the performance in the End Semester Examinations, 50 marks shall be awarded based on the day-to-day performance as Internal marks**.** A candidate has to secure a minimum of 50% in the external examination and has to secure a minimum of 50% on the aggregate to be declared successful.

d. There shall be a seminar presentation during III semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of the Head of the Department, supervisor and two other senior faculty members of the department. For Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful.

e. For Seminar in I, II Semesters in case of the course structure of having 5 Theory + 2 Labs. + 1 Seminar, a student has to deliver a seminar talk in each of the subjects in that semester which shall be evaluated for 10 marks each and average marks allotted shall be considered. A letter grade from A to C corresponding to the marks allotted may be awarded for the two credits so as to keep the existing structure and evaluation undisturbed.

A – Excellent	(average marks $\geq$ 8)
B – Good	(6$\leq$ average marks <8)
C – Satisfactory	(5$\leq$ average marks <6)

If a satisfactory grade is not secured, one has to repeat in the following semester.

f. In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.0 a, c) he has to reappear for the End Examination in that subject.

A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and he has failed in the subject. In such a case the candidate must re-register for the subject (s) and secure required minimum attendance. Attendance in the re-registered subject (s) has to be calculated separately to become eligible to write the end- examination in the re-registered subject(s). In the event of re-registration, the internal marks and end examination marks obtained in the previous attempt are nullified.

g. In case the candidates secure less than the required attendance in any subject(s), he shall not be permitted to appear for the End Examination in that subject(s). He shall re-register for the subject(s) when next offered.

h. Laboratory examination for M.Tech subjects must be conducted with two Examiners, one of them being Laboratory Class Teacher and second examiner shall be other than Laboratory Teacher.

6.0 EVALUATION OF PROJECT / DISSERTATION WORK:

Every candidate shall be required to submit the thesis or dissertation after taking up a topic approved by the Departmental Research Committee (DRC).

a. A Departmental Research Committee (DRC) shall be constituted with the Head of the Department as the chairman and two senior faculty as members to oversee the proceedings of the project work from allotment to submission.5

b. A Central Research Committee (CRC) shall be constituted with a Senior Professor as chair person, Heads of all the Departments which are offering the M.Tech programs and two other senior faculty members.
c. Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects.)
d. After satisfying 6.0 c, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the DRC for its approval. Only after obtaining the approval of DRC the student can initiate the Project work
e. If a candidate wishes to change his supervisor or topic of the project he can do so with approval of DRC. However, the Departmental Project Review Committee shall examine whether the change of topic/supervisor leads to a major change in his initial plans of project proposal. If so, his date of registration for the Project work shall start from the date of change of Supervisor or topic as the case may be whichever is earlier.
f. A candidate shall submit and present the status report in two stages at least with a gap of 3 months between them after satisfying 6.0 d.
g. The work on the project shall be initiated in the beginning of the second year and the duration of the project is for two semesters. A candidate shall be permitted to submit his dissertation only after successful completion of all theory and practical subject with the approval of CRC but not earlier than 40 weeks from the date of registration of the project work. For the approval by CRC the candidate shall submit the draft copy of the thesis to

the Principal through the concerned Head of the Department and shall make an oral presentation before the CRC.

h. Three copies of the dissertation certified by the supervisor shall be submitted to the College after approval by the CRC.
i. The dissertation shall be adjudicated by one examiner selected by the Principal. For this HOD shall submit in consultation with the supervisor a panel of 5 examiners, who are experienced in that field.
j. If the report of the examiner is not favorable, the candidate shall revise and resubmit the dissertation, in a time frame as prescribed by the CRC. If the report of the examiner is unfavorable again, the dissertation shall be summarily rejected then the candidate shall change the topic of the Project and option shall be given to change the supervisor also.
k. If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the Department and the examiner who adjudicated the dissertation. The Board shall jointly report candidate's work as:
    A. Excellent
    B. Good
    C. Satisfactory

7.0 AWARD OF DEGREE AND CLASS :

A candidate shall be eligible for the respective degree if he satisfies the minimum academic requirements in every subject and secures satisfactory or higher grade report on his dissertation and viva-voce.

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M.Tech. Degree he shall be placed in one of the following three

classes.

% of Marks secured	Class Awarded
70% and above	First Class with Distinction
60% and above but less than 70%	First Class
50% and above but less than 60%	Second Class

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

The grade of the dissertation shall also be mentioned in the marks memorandum.

8.0 WITHHOLDING OF RESULTS:

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

9.0 TRANSITORY REGULATIONS:

A candidate who has discontinued or has been detained for want of attendance or who has failed after having studied the subject is eligible for admission to the same or equivalent subject(s) as and when subject(s) is/are offered, subject to 6.0 e and 2.0

10.0 GENERAL

1. The academic regulations should be read as a whole for purpose of any interpretation.
2. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman Academic Council is final.

3. The College may change or amend the academic regulations and syllabus at any time and the changes amendments made shall be applicable to all the students with effect from the date notified by the College.
4. Wherever the word he, him or his occur, it will also include she, hers.

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COURSE STRUCTURE

I SEMESTER

COURSE CODE	Theory / Lab	L	P	C
10ME2101	Computer Aided Design	4	-	4
10ME2102	Vibration Engineering	4	-	4
10ME2103	Finite Element Analysis	4	-	4
10ME2104	Design Optimization	4	-	4
10ME2105	Advanced Tool Design	4	-	4
	Elective – I	4	-	4
10ME2106	Mechatronics			
10ME2107	Design for Manufacturing & Assembly			
10ME2108	Manufacturing Methods & Mechanics of Composites			
10ME2109	Advanced Mechanism Design			
10ME2110	Total Quality Management	-	3	2
10ME2111	Computer Aided Design & Optimization Laboratory	**24**	**3**	**26**

II SEMESTER

COURSE CODE	Theory / Lab	L	P	C
10ME2112	Computer Aided Manufacturing	4	-	4
10ME2113	Flexible Manufacturing Systems	4	-	4
10ME2114	Industrial Robotics	4	-	4
10ME2115	Design of Hydraulics & Pneumatic Systems	4	-	4
10ME2116	Automation in Manufacturing	4	-	4
	Elective – II			
10ME2117	Intelligent Manufacturing Systems			
10ME2118	Computer Aided Process Planning			
10ME2119	Computational Fluid Dynamics			
10ME2120	Advanced Manufacturing Technology			
10ME2121	Metrology and Non-Destructive Testing			
10ME2122	Computer Aided Manufacturing & Robotics Laboratory	-	3	2
	Total	**24**	**3**	**26**

III SEMESTER

COURSE CODE	THEORY/LAB	L	P	C
	Commencement of Project Work			
10ME21S1	SEMINAR	**-**	**-**	**2**

IV SEMESTER

COURSE CODE	THEORY/LAB	L	P	C
10ME2123	PROJECT WORK DISSERTATION / THESIS EXCELLENT/GOOD/SATISFACTORY/ NON-SATISFACTORY	**-**	**-**	**56**

COMPUTER AIDED DESIGN

Course Code: 10ME2101

L	P	C
4	0	4

UNIT-I

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

UNIT-II

WIRE FRAME MODELLING: Types of mathematical representation of curves, wire frame models, wire frame entities parametric representation of synthetic curves, hermite cubic splines, Bezier curves, B-splines rational curves

UNIT-III

SURFACE MODELLING: Mathematical representation of surfaces, Surface model, Surface entities, surface representation, Parametric representation of surfaces, plane surface, ruled surface, surface of revolution, Tabulated Cylinder.

UNIT-IV

PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES: Hermite Bi-cubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface , Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

UNIT V

SOLID MODELLING: Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG).

UNIT VI

CAD/CAM EXCHANGE: Evaluation of data – exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.

UNIT-VII

DESIGN APPLICATIONS: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis, Mechanical Assembly.

UNIT VIII

COLLABORATIVE ENGINEERING: Collaborative Design, Principles, Approaches, Tools, Design Systems.

Text books:

1. Ibrahim Zeid, "CAD/CAM Theory and Practice", 5e, McGraw Hill International, 2009.
2. Ibrahim Zeid, "Mastering CAD/CAM", 1e, Mc Graw Hill International, 2008.

Reference Books

1. PN Rao, "CAD/CAM", 2e, Tata McGraw Hill, 2010.
2. Kunwoo lee, "Principles of CAD/CAM/CAE", Prentice Hall India, 1999.
3. Pere Brunet, "Cad Tools and algorithms for product design", Springer,2000.

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VIBRATION ENGINEERING

Course Code: 10ME2102

L	P	C
4	0	4

UNIT – I

Introduction – Types of Vibration – Free, Forced and damped vibrations - longitudinal, transverse and torsional vibrations – terminology - single degree of freedom systems – spring mass system – derivation of differential equation – solution – torsional vibration – equivalent stiffness – spring combinations – springs in series and springs in parallel.

UNIT – II

Free vibrations of damped single degree of freedom systems - different types of damping – logarithmic decrement – frequency of damped vibrations. Forced vibration of single degree of freedom system – constant harmonic excitation – steady state vibrations – forced vibrations with rotating and reciprocating unbalance – forced vibration due to excitation of support – vibration isolation – transmissibility

UNIT – III

Two degree of freedom systems – Principal modes of vibration - Two masses fixed on tightly stretched string – Double pendulum – Torsional system with damping – Forced vibration with harmonic excitation – undamped dynamic vibration absorber – untuned viscous damper.

UNIT – IV

Multi degree of freedom systems – exact analysis - free vibrations – equations of motion – influence coefficients - generalized co-ordinates – Co-ordinate coupling – Natural frequencies and mode shapes – eigenvalues and eigenvectors - orthogonal properties of normal modes – modal analysis

UNIT – V

Continuous systems – vibration of strings – longitudinal vibrations of bars – torsional vibrations of circular shafts - lateral vibration of beams.

UNIT – VI

Multi degree of freedom systems – Numerical methods – Rayleigh`s method – Dunkerley`s method – Stodola`s method – Rayleigh Ritz method – Method of matrix iteration – Holzer's method for natural frequencies of multi rotor systems.

UNIT – VII

Critical speeds of shafts – Critical speed of a light shaft having a single disc – without damping and with damping. Critical speed of a shaft having multiple discs – secondary critical speed.

UNIT VIII

Transient vibrations – Introduction – Response to an impulsive input – response to a step input.

Text book:

1. G.K. Grover, "Mechanical Vibrations," Nemchand & Bros, Roorke, 8e, 2009.

References Books:

1. William T Thomson & Marie Dillon Dahleh, "Theory of Vibrations with application," 5e, Pearson Education Publication, 2007.
2. Rao S.S. ,"Mechanical Vibrations",4e, Pearson Education Inc.,2003.
3. Tse, Morse and Hinkel, "Mechanical Vibrations", Chapman and Hall, 1991.
4. Den Hartong J.P., "Mechanical Vibrations", McGraw Hill, 1986.
5. V.P.Singh, "Mechanical vibrations",3e, Dhanpat Rai & Co.,2006.

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FINITE ELEMENT ANALYSIS

Course Code: 10ME2103

L	P	C
4	0	4

UNIT-I

Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of FEM with other methods, variational approach, Galerkin Methods

UNIT-II

Co-ordinates, basic element shapes, interpolation function. Virtual energy principle, Rayleigh- Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain displacement relations

UNIT -III

1-D structural problems – axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape function. Analysis of Trusses – Plane Truss and Space Truss elements.

UNIT-IV

Analysis of beams – Hermite shape functions – stiffness matrix – Load vector – Problems. 2-D problems – CST, LST, force terms, Stiffness matrix and load vector, boundary conditions.

UNIT–V

Isoparametric element – quadrilateral element, Shape functions – Numerical Integration – sub parametric and super parametric elements. 3-D problems – Tetrahedron element – Jacobian matrix – Stiffness matrix

UNIT-VI

Scalar field problems - 1-D Heat conduction – 1-D fin element – 2-D heat conduction problems – Introduction to Torsional problems.

UNIT-VII

Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen values, Eigen vectors, natural frequencies – mode shapes – modal analysis.

UNIT–VIII

Non linearity-Introduction, Non-linear problems, geometric non linearity, Non-linear dynamic problems, analytical problems.

Text books:

1. Tirupathi K.Chandrupatla and Ashok D.Belegundu, "Introduction to finite elements in engineering",3e, Pearson Education,2010

Reference Books

1. Robert Cook ,"Concepts and applications of finite element analysis",4e,John Wiley and sons,2009.
2. S.S. Rao ,"The finite element methods in Engineering",1e, Pergamon, New York,2010.
3. J. N. Reddy," An Introduction to Finite Element Methods",2e, McGraw Hill,2009.
4. O.C. Zienkowitz," The Finite element method in engineering science",3e, McGraw Hill,2010.
5. K.J Bathe ,"Finite Element Procedures in Engineering analysis",1e,PHI,2009 –
6. C.S.Krishnamoorthy ,"Finite Element Analysis - Theory and Programming",2e,Mc Graw Hill,2009

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DESIGN OPTIMIZATION

Course Code: 10ME2104

L	P	C
4	0	4

UNIT-I

Introduction -General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints, classification of optimization problems - single variable – multivariable - unconstrained – equality constrained and inequality constrained problems.

UNIT-II

Unconstrained non-linear single variable optimization -Unimodal function, Methods of single variable optimization - Newton method, modified Newton method, Bi-section method, Unrestricted, Dichotomous, Fibonacci, Golden Section, Quadratic search, Cubic search methods.

UNIT-III

Methods of non-linear multivariable optimization - Direct search methods: Random, Univariate, Pattern search methods, Rosenbrock's rotating coordinates method. – Descent methods: Steepest descent method, Fletcher-Reeves method, Newton's method, Conjugate gradient methods.

UNIT-IV

Constrained non-linear optimization - Characteristics of a constrained optimization problem - Direct and Indirect methods - Cutting plane method – Interior and exterior penalty function methods, Lagrange multipliers.

UNIT- V

Geometric programming - Solution from differential calculus point of view – Solution from arithmetic-geometric inequality point of view. Degree of difficulty of optimization problems. Optimization of zero and single degree of difficulty problems.

UNIT-VI

Stochastic programming, Concepts of Multi-objective Optimization and Multi-stage optimization

UNIT-VII

Advanced Non-linear Optimization - Genetic Algorithms -Working principle-Genetic operators-Numerical problem; Simulated Annealing - Numerical problem; Neural network based optimization.

UNIT-VIII

Engineering applications - Structural-design application axial and transverse loaded members for minimum cost, minimum weight. Optimal design of shafts, springs. Application in mechanisms for minimum structural error.

Text books:

1. Singerusu S. Rao, “Engineering Optimization -Theory and Practice”, 1e, New Age International, (P) Ltd, New Delhi,1996
2. Kalyanmoy Deb, "Optimization for Engineering Design-Algorithms and Examples", 2e, PHI, 1996.

References Books:

1. Ashok D. Belegundu and Tirupathi R. Chandrupatla, “Optimization Concepts and Applications in Engineering”,1e, Pearson Education, Asia, 2002
2. Johnson, Ray C., Optimum Design of Mechanical Elements”, 1e, Jeohnson Wiley & Sons, Ic., NY, 1980.
3. Goldberg D. E., “Genetic Algorithms in search, Optimization and Machine learing ”, 1e, Pearson Education, NY,1989.

ADVANCED TOOL DESIGN

Course Code: 10ME2105

L	P	C
4	0	4

UNIT-I
TOOL DESIGN METHODS

Introduction, Design procedure, Statement of the problem, Needs Analysis – Tentative design solutions, finished design, Drafting and design techniques in tooling drawings, Punch and die Manufacturing Techniques.

UNIT- II
TOOLING MATERIALS

Introduction, Properties of tool materials, Metal cutting tools, Single-point cutting tools, Milling cutters, Drills and Drilling, Reamer classification, Taps, Tap classification, The selection of carbide cutting tools, Determining the insert thickness for carbide tools, Various heat treatments.

UNIT- III
GAGES AND GAGE DESIGN

Introduction, Fixed Gages, Gage Tolerances, The selection of material for Gages, Indicating Gages, and Automatic gages.

UNIT- IV
DESIGN OF DRILL JIGS

Principles of location, Locating methods and devices, Principles of clamping, Drill jigs, Chip formation in drilling, General considerations in the design of drill jigs, Drill bushings, Methods of construction, Drill jigs and modern manufacturing, Computer aided Jig design.

UNIT- V

DESIGN OF FIXTURES

Introduction, Fixtures and economics, Types of Fixtures, Vise Fixtures, Milling Fixtures, Boring Fixtures, Broaching Fixtures, Lathe Fixtures, Grinding Fixtures, Types of Die construction, Computer aided Fixture Design,

UNIT- VI

DESIGN OF DIES

Die-design fundamentals, Blanking and Piercing die construction, Pilots, Strippers and pressure pads, Presswork materials, Strip layout, Short - run tooling for Piercing, Bending dies, Forming dies, Drawing operations.

UNIT- VII

MOULD DESIGN

Types, parts, temperature controlling, splits in mould, split locking, two-cavity and multi-cavity moulds, construction and design details of injection moulds.

UNIT-VIII

FIXTURE AND TOOL DESIGN FOR NC MACHINES

Fixture design for NC machine tools. Cutting tools for numerical control, Tool holding methods for numerical control, Automatic tool changers and tool positioners. Tool presetting, tooling for Automatic screw machines.

Text book:

1. Donaldson, Cyrll, George H. LeCain, Goold, V.C., "Tool Design", TMH, 36th Reprint 2006.

References Books:

1. Joshi, Prakash Hiralal, "Tooling data", Wheeler Publishing, 2000
2. Sharma, P.C., "Machine Tool and Tool Design ", S Chand Company. 2004.
3. Mehta N.K., "Machine Tool Design",Tata McGraw Hill, 1989.

4. Paquin, J. R. and Crowley, R. E., “Die design fundamentals”, “Ind. 3e, Ind.Press Inc., New York, 1987
5. ASTME Hand Book, Tool Design, Vol 1, 1990.

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MECHATRONICS

Course Code: 10ME2106

L	P	C
4	0	4

UNIT-I

Mechatronics system design: Introduction to Mechatronics: What is mechatronics, Integrated design issues in mechatronics, Mechatronics key elements, The mechatronics design process, Advanced approaches in mechatronics.

UNIT-II

Modelling and simulation of physical systems: Simulation and block diagrams, Analogies and impedance diagrams, Electrical systems, Mechanical translational systems, Mechanical rotational systems, Electromechanical coupling, Fluid systems.

UNIT-III

Sensors and transducers: An introduction to sensors and transducers, Sensors for motion and position measurement, Force, torque and tactile sensors, Flow sensors, Temperature-sensing devices.

UNIT-IV

Actuating devices: DC and AC drives – Servo motors and stepper motor – hydraulic and pneumatic drives – piezoelectric and magnetostrictive actuators – micro actuators.

UNIT-V

Microcontroller programming: Microcontrollers, The PIC16F84 microcontroller, programming a PIC, PicBasic Pro programming fundamentals, examples, Use of Interrupts.

UNIT-VI

Signals, systems and controls: Introduction to signals, systems and controls, System representation, Linearization of nonlinear systems, Time delays.

UNIT-VII

Real time interfacing: Introduction, Elements of a data acquisition and control system, Overview of the I/O process, Installation of the I/O card and software.

UNIT-VIII

Advanced applications in mechatronics: Sensors for condition monitoring, Mechatronic control in automated manufacturing, Artificial intelligence in mechatronics, Microsensors in mechatronics.

Text book:

1. Devdas Shetty and Richard A. Kolk, "Mechatronics System Design," P.W.S.Publishing Co., 2001
2. Bolton, "Mechatronics," ,3e, Pearson Education, Asia, 2001

Reference books:

1. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems,", 3e, Tata McGraw Hill Company Ltd., 2003.
2. D.A. Bradley, D. Dawson, N.C. Buru and A.J. Loader, " Mechatronics ", 1e, Chapman and Hall, 1993.
3. Robert H. Bishop. Editor-in-chief. "The Mechatronics Handbook", CRC Press, with ISA– The Instrumentation, Systems, Automation Society, 2002.

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DESIGN FOR MANUFACTURING AND ASSEMBLY

Course Code: 10ME2107

L	P	C
4	0	4

UNIT-I

Introduction :Design philosophy – steps in Design process – General Design rules for manufacturability – basic principles of designing for economical production – creativity in design. Application of linear & non-linear optimization techniques.

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 PROCESS: 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 tolerances – use of solidification simulation in casting design – product design rules for sand casting.

UNIT-IV

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-V

FORGING – Design factors for Forging – Closed die forging design – parting lines of dies – drop forging die design – general design recommendations

UNIT-VI

EXTRUSION & SHEET METAL WORK: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing – Keeler Goodman Forming Line Diagram – Component Design for Blanking.

UNIT-VII

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

UNIT-VIII

ASSEMBLY: Compliance analysis and interference analysis for the design of assembly – Design and development of features for automatic assembly – liaison diagrams.

Text books:

1. A K Chitale, R C Gupta " Product Design and Manufacturing", PHI, New Delhi, 2003.

Reference Books :

1. George E Deiter, " Engineering Design", Mc GrawHills Intl, 2002.
2. John Cobert, "Design for Manufacturing", Addison Welsely, 2000.
3. Surender Kumar and Gautham S., " Design and Manufacturing", oxford & IBH Publishing Co Pvt Ltd, New Delhi, 1998.
4. Material Selection and Design Handbook, Vol – 20, ASM International, 1997.

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MANUFACTURING METHODS AND MECHANICS OF COMPOSITES

Course Code: 10ME2108

L	P	C
4	0	4

UNIT – I

Basic concepts and characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites

UNIT – II

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT – III

Micromechanics: Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

UNIT – IV

Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

UNIT – V

Coordinate transformations: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off –

axis, stiffness modulus, off - axis compliance.

UNIT – VI

Elastic behavior of unidirectional composites: Elastic constants of lamina, relation ship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

UNIT – VII

Strength of unidirectional lamina: Micro mechanics of failure, Failure mechanisms, Strength of an orthotropic lamina, Strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micro mechanical predictions of elastic constants.

UNIT – VIII

Analysis of laminated composite plates

Introduction, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

Text Books:

1. R. M. Jones, "Mechanics of Composite Materials", Mc Graw Hill Company, New York, 1975.

References Books

2. Isaac and Daniel, "Engineering Mechanics of Composite Materials", Oxford Univ. Press, 1994.
3. B. D. Agarwal and L. J. Broutman, "Analysis and performance of fibre Composites", Wiley- Interscience, New York, 1980.
4. L. R. Calcote, "Analysis of Laminated Composite Structures", Van Nostrand Rainfold, NY, 1969.

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ADVANCED MECHANISM DESIGN

Course Code: 10ME2109

L	P	C
4	0	4

UNIT– I

Introduction – Review of fundamentals of kinematics - Analysis and Synthesis – Terminology, Definitions and Assumptions – planar, spherical and spatial mechanisms' mobility – classification of mechanisms – kinematic Inversion – Grashof`s law.

UNIT– II

Position and displacement – complex algebra solutions of planar vector equations – coupler curve generation velocity – analytical methods - vector method – complex algebra methods – Freudenstein's theorem.

UNIT– III

Planar complex mechanisms - Kinematic analysis - low degree complexity and high degree complexity. Hall and Ault`s auxiliary point method – Goodman's indirect method for low degree of complexity mechanisms.

UNIT – IV

Acceleration – Analytical methods – Chase solution - Instant centre of acceleration. Euler-Savory equation - Bobillier construction.

UNIT - V

Synthesis of mechanisms: Type, Number and Dimensional synthesis – Function generation – two position synthesis of slider crank and crank-rocker mechanisms with optimum transmission angle – Three position synthesis – Structural error – Chebychev spacing - Cognate linkages – Robert-Chebychev theorem – Block's method of synthesis. Freudenstein's equation.

UNIT - VI

Static force analysis of planar mechanism – Static force analysis of planar mechanism with friction – Method of virtual work.

UNIT - VII

Dynamic force analysis of planar mechanisms - Combined static and inertia force analysis

UNIT - VIII

Kinematics analysis of spatial Revolute-Spherical-Spherical-Revolute mechanism – Denavit-Hartenberg parameters – Forward and inverse kinematics of Robotic manipulators.

Text Books :

1. Shighley Joseph Edward and Uicker John Joseph , "Theory of Machines and Mechanism," ,2e, McGraw Hill, 1985.
2. Amitabha Ghosh and Ashok kumar Mallik, "Theory of Mechanisms and Machines,",3e, EWP, 1999.

Recommended Books:

1. Sandor G.N. and Erdman. A.G., "Advanced Mechanism Design Analysis and Synthesis," Volume-I,II PHI, 1984.
2. Rao V. Dukkipati, "Spatial Mechanisms",1e, Narosa publishers, 2009.

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TOTAL QUALITY MANAGEMENT

Course Code: 10ME2110

L	P	C
4	0	4

UNIT -I

Introduction to Quality – definitions - TQM – overview – History – Stages of Evolution - elements – definitions – continuous improvement – objectives – internal and external customers - customer satisfaction and customer delight.

UNIT-II

Quality standards – Need of standardization - Institutions – bodies of standardization, ISO 9000 series – ISO 14000 series – other contemporary standards. Quality models such as KANO, Westinghouse.

UNIT -III

Quality measurement systems (QMS) – developing and implementing QMS – non conformance database. Inspection, nonconformity reports, QC, QA. Quality costs, Tools of quality.

UNIT-IV

Problem Solving - Problem Solving process – corrective action – order of precedence – system failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis. Cause and effect analysis, FMEA case studies.

UNIT-V

Quality circles – organization – focus team approach – statistical process control – process chart – Ishikawa diagram – preparing and using control charts. SQC, Continuous improvement – 5 S approach, Kaizen, Reengineering concepts, maintenance and quality methods.

UNIT-VI

Quality Function Development (QFD) – elements of QFD – bench marking – Taguchi Analysis – loss function - Taguchi design of experiments. Reliability models, reliability studies.

UNIT-VII

Value improvement elements – value improvement assault – supplier teaming. Vendor appraisal and analysis, Lean engineering.

UNIT -VIII

Six sigma approach – application of six sigma approach to various industrial situations. Methodology, infrastructure requirements, implementation, case studies.

Text books :

1. P. N. Mukharjee,"Total Quality Management",PHI, New Delhi,2006.
2. N.S. Sreenivasan and V. Narayana, "Total Quality Management with Six Sigma -A Practical Guide to be a world class company", Quality Circle forum of India, Hyderabad, 2003.
3. Subbaraj Ramasamy, "Total Quality Management", Tata McGraw Hill, New Delhi, 2005

Reference Books:

1. Joseph and Susan Berk ,"Total Quality Management ".
2. Howared giltow," Quality management", TMH
3. DaleH. Beterfield et al, "Total Quality Management", Pearson Education Asia, 2001.
4. John Bank J.E., "Total Quality Management", Prentice Hall, India, 1993.
5. R. Ramakrishnan, "Total Quality Management", Eswar Press, Chennai, 2005.
6. TQM, Suganti & Samuel PHI,
7. "QM, Creating & Sustaining organization effectiveness", Summers, PHI

COMPUTER AIDED DESIGN AND OPTIMIZATION LABORATORY

Course Code: 10ME2111

L	P	C
0	3	2

To conversion 2D to 3D solid model.

- To make a conceptual design for a new product design and development.
- To create 3D model of real time components using CAD software.
- To prepare a detailed drawing from 3D model of any components for manufacturing process.
- To prepare a 3D model of any product for the down stream application.
- To perform 2D and 3D modeling and assembly.
- To perform static analysis.
- To perform Modal analysis.
- To perform Harmonic analysis.
- To perform Transient analysis.
- To perform thermal analysis.
- To carryout single variable unconstrained & constrained nonlinear optimization.
- To carryout multivariable unconstrained nonlinear optimization.
- To carryout multivariable constrained nonlinear optimization.
- To carryout multi-objective optimization.

Modelling packages: AutoCAD, CATIA, Pro-E
Analysis packages: ANSYS, NISA.
Optimization: MATLAB

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COMPUTER AIDED MANUFACTURING

Course Code: 10ME2112

L	P	C
4	0	4

UNIT-I

Introduction to NC, DNC, CNC. Classification of NC systems - Open loop and Closed loop control systems, Drives and Controls,Interpolators. Design considerations of NC machine tools.

UNIT-II

Components of NC / CNC system - Machine control unit, Part program, tooling. Classification of NC / CNC machines Nomenclature of NC machine axes, Types of NC machine tools and their constructional features. Machining centres, Automatic tool changer (ATC), Turning centres.

UNIT-III

Functions of Machine control unit (MCU), NC actuation systems, Part program to command signal, MCU organization, Computerized numerical control, Transducers for NC machine tools.

UNIT-IV

Tooling for NC machines - Tooling for NC machining centres and NC turning machines, Tool presetting equipment. Flexible tooling systems.

UNIT-V

Manual part programming: Part program instruction formats, Information codes: Preparatory function, Miscellaneous functions, Tool code and tool length offset, Interpolations, Canned cycles. Manual part programming for milling operations, Turning operations, Parametric subroutines.

UNIT-VI

Computer aided part programming: NC languages: APT, NELAPT, EXAPT, GNC, VNC, Preprocessor, Post processor. CNC part programming with CAD/CAM systems.

UNIT-VII

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, complication control commands. Macro subroutines. Part programming with numerical examples.

UNIT-VIII

Adaptive control systems: Introduction - Adaptive Control with Optimization for a milling machine- Adaptive Control with Constraints for lathe – Adaptive control of grinding

Text Books:

1. T.K Kundra, P.N. Rao and N.K. Tewari, " Numerical control and computer Aided Manufacturing" Tata Mc Graw Hill Company, 1995.
2. Yoram Koren, "Computer control of Manufacturing Systems", 6e,TMH, 2009

References Books:

1.Mikell P.Groover, "Automation, Production systems and computer Integrated manufacturing" 8e,PHI, 2008
2. David Bedworth, "Computer integrated design and manufacturing" TM, 1991.
3. Paul G. Ranky, "Computer Integrated Manufacturing" Prentice Hall International, 1986.

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FLEXIBLE MANUFACTURING SYSTEM

Course Code: 10ME2113

L	P	C
4	0	4

UNIT-I

Types of production, production planning and control, Manufacturing in a competitive environment, Concept, Automation of manufacturing process , Numerical control, Adaptive control, Material handling and movement, Industrial robots, Flexible fixturing, Design for assembly, Disassembly and service.

UNIT-II

Group Technology – composite part families - classification and coding - Production flow analysis, Planning issues: Components of FMS, Types of flexibility, tradeoffs, Computer control and functions, Planning, scheduling and control of FMS, Scheduling and knowledge-based scheduling.

UNIT-III

Hierarchy of computer control, Supervisory computer, Introduction to turning center, Machining center, cleaning and deburring equipment, coordinate measuring machines: Types, Working, Capabilities.

UNIT-IV

System support equipment, Types working capability, Automated material movement and automated storage and retrieval systems, Scheduling of AGVs, Cutting tools and tool management, Work holding considerations.

UNIT-V

FMS computer hardware and software, General structure and requirements, PLCs, FMS installation and implementation, Acceptance testing.

UNIT-VI

Computer Software, Simulation and Database of FMS: System issues, Types of software, Specification and selection, Trends, Application of simulation, Software, Manufacturing data systems, Data flow, CAD/CAM considerations, Planning FMS database.

UNIT-VII

Characteristics of JIT, Pull method, Small lot sizes, Work station loads, Flexible work force, Line flow strategy. Supply chain management.

UNIT-VIII

Preventive maintenance - Kanban system, Value engineering, MRD JIT, Lean manufacture, Quality concepts and management.

Text Books:

1.Jha N.K. "Handbook of Flexible Manufacturing Systems"8e, Academic Press Inc., 1991.

2. Kalpakjian, "Manufacturing Engineering and Technology ", Addison-Wesley Publishing Co., 1995.

Reference Books:

1. Mikell P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", PHI, 2008.

2. Taiichi Ohno, Toyota, "Production System Beyond Large-Scale production ", Productivity Press (India) Pvt. Ltd., 1992.

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INDUSTRIAL ROBOTICS

Course Code: 10ME2114

L	P	C
4	0	4

UNIT–I

Introduction: Automation and Robotics. Robot anatomy, Robot configuration motions. Joint notation, work volume, robot drive systems, control systems and dynamic performance, precision of movement.

UNIT–II

CONTROL SYSTEMS AND COMPONENTS: Basic concepts and models, controllers. control system analysis, Robot Activation and feedback components. Position sensors, . Velocity sensors, Actuators.Power, Transmission systems.

UNIT–III

MOTION ANALYSIS AND CONTROL: Manipulator Kinematics, Position Representation Forward Transformation, Homogenous Transformations, Manipulator path control Robot Dynamics, Configuration of a Robot Controller.

UNIT–IV

END EFFECTORS: Grippers-Types, operation, mechanism, Force analysis, Tools as end effectors, Considerations in gripper selection and design.

SENSORS-Desirable features, Tactile, Proximity and Range sensors, Uses of sensors in Robotics.

UNIT–V

MACHINE VISION: Functions, Sensing and Digitizing-Imaging, devices, lighting techniques, Analog to digital signal conversion, Image

storage, Image processing and Analysis-Image Data Reduction, Segmentation, Feature, Extraction, Object
Recognition, Training the vision system, Robotics Applications.

UNIT-VI

ROBOT PROGRAMMING: Lead through programming, Robot programming as a path in space, mation interpolation, WAIT, SIGNAL and DELAY commands, branching capabilities and limitations.
ROBOT LANGUAGES: Textual Robot languages, generations, Robot language structures, Elements in functions.

UNIT-VII

ROBOT CELL DESIGN AND CONTROL: Robot cell layouts-Robot centered cell. Inline Robot cell, Mobile Robot Cell, Considerations in work design, work cell control, Inter locks, Errors detection, Work cell controller.

UNIT-VIII

ROBOT APPLICATIONS : Material transfer, Machine Loading/ Unloading, Processing Operations, Assembly and Inspections.

Text Books:

1. M.D Groover, M Weiss, R M gnagel and N G Ordrey,"Industrial Robotics", M C Gram Hill, 1986.

Reference Books:

1. R.K. Mittal, I J Nagrath, " Robotics and Control", Tata Mc Graw Hill, 2003.

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DESIGN OF HYDRAULICS AND PNEUMATIC SYSTEMS

Course Code: 10ME2115

L	P	C
4	0	4

UNIT-I: Introduction to Hydraulic Systems and Ancillary Hydraulic Systems

Introduction to Hydraulic Systems, Design and Construction of Hydraulic Reservoir and Sizing, Gravity type, Spring-loaded and Gas loaded type Accumulators

UNIT-II: Hydraulic Pumps

Gear pumps, Vane pumps and Piston pumps, Sizing of Hydraulic Pumps, Selection of Hydraulic Pumps

UNIT-III: Hydraulic Control Valves

Direction Control Valves, Pressure Control Valves, Flow Control Valves, Servo Valves

UNIT-IV: Hydraulic Cylinders and Hydraulic Motors

Hydraulic cylinder operation and cylinder mountings, Hydraulic cylinder Design and Cushions, Hydraulic Motors operation- Gear, Vane and Piston motors, Hydraulic Motor performance, Hydrostatic Transmissions

UNIT- V: Hydraulic circuit Design & Analysis

Control of single and double acting cylinders, Regenerative and pump unloading circuit, Hydraulic Cylinder Sequence and Synchronizing Circuits, Speed Control of Hydraulic Cylinder and motor, Hydraulic Motor breaking system

UNIT-VI: Pneumatics: Circuits and Applications
Introduction to Pneumatics, Pneumatic Circuit Design considerations, Basic Pneumatic Circuits and Analysis

UNIT-VII: Maintenance and Trouble shooting of hydraulic & pneumatic circuits and Components
Oxidation and Corrosion of Hydraulic Fluids, Maintaining and Deposing of Fluids, Wear of moving parts due to solid particle contamination of the fluid, Problems caused by gases in Hydraulic Fluids, Troubleshooting of Hydraulic System, Common problems in Pneumatic Systems, Troubleshooting of Pneumatic Systems

UNIT – VIII: Advanced Electrical controls for fluid power systems
Components of Electro-Hydraulic Servo Systems, Analysis of Electro-Hydraulic Servo Systems, Programmable Logic Controllers (PLCs)

Text Books:
1. Anthony Esposito, "Fluid Power with Applications" 9e, Pearson Education, 2007.
2. Andrew Parr, "Hydraulics and Pneumatics", 4e, Jaico Publishing house ,2005

Reference Books:
1. S.R.Majumdar, " Oil Hydraulic Systems", Tata Mc Graw Hill, 2012.
2. S.R.Majumdar " Pneumatic Systems", Tata Mc Graw Hill, 1995.
3. www.pneumatics.com
4. www.fluidpower.com.tw

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AUTOMATION IN MANUFACTURING

Course Code: 10ME2116

L	P	C
4	0	4

UNIT – I:

Fundamentals of Manufacturing Automation: Introduction to CAD/CAM and CIM methods of production – Functions in manufacturing – Organization and information processing in manufacturing – Automation – reasons, types.

Production Operations and Automation Strategies: Plant Layout production concepts and mathematical models – Automation strategies.

UNIT – II:

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

UNIT – III

Analysis of Automated flow lines: Analysis of transfer lines without storage – partial automation automated flow lines with storage buffers – Automated guided vehicle system, automated storage / retrieval systems – types, basic components and applications.

UNIT – IV

Assembly systems and Line Balance: Manual assembly lines – line balancing problem – methods of line balancing – ways to improve line balancing – flexible manual assembly lines – automated assembly systems, Automated assembly systems, Analysis of multi station assembly.

UNIT V

Automated Material Handling: Types of equipment and functions, design and analysis of material handling system, conveyor systems. Automated guided vehicle system, component operating, types design of automated guided vehicles and applications. Automated storage retrieval system – types, basic components and applications.

UNIT – VI

Group Technology and process planning: Part families, part classification and coding, machine Cell design, Benefits

UNIT VII

Computer Aided Process Planning: Planning function, Retrieval type. Process planning system, Generative process benefits and limitations.
Automatic Identification Techniques: Shop floor control factory data collection system – bar code techniques.

UNIT-VIII

Automated inspection and testing : automated inspection principles and methods – sensors techniques for automated inspection – techniques for automated inspection – contact and non contact inspection methods – in process gauging CMM`s construction types inspection probes, types and applications machine vision LASER micrometer and optical inspection methods.

Text Books:

1. Mikell P. Grover. "Automation, Production Systems and CIM",8e, PHI Pvt Ltd., 1998.

Reference Books:

2. P.Radha Krishnan & S.Subrahamanyam & Raju," CAD/CAM/CIM", 2 e, New Age Intl. Publishers, 2003.
3. Singh, " System Approach to computer Integrated Design and Manufacturing " John wiley, 1996.

INTELLIGENT MANUFACTURING SYSTEMS

	L	P	C
Course Code: 10ME2117	**4**	**0**	**4**

UNIT I:
Computer Integrated Manufacturing Systems – Structure and functional areas of CIM system - CAD,CAPP, CAM, CAQC, ASRS. Advantages of CIM.

UNIT II:
Manufacturing Communication Systems – MAP/TOP, OSI Model, Data Redundancy, Top-down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing – System Components, System Architecture and Data Flow, System Operation.

UNIT III:
Components of Knowledge Based Systems – Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT IV:
Machine Learning – Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks -Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

UNIT V:
Automated Process Planning – Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning.

UNIT VI:

Knowledge Based System for Equipment Selection (KBSES) – Manufacturing system design, Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KBSES.

UNIT VII:

Group Technology: Models and Algorithms – Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation – Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method.

UNIT VIII:

Knowledge Based Group Technology - Group Technology in Automated Manufacturing System, Structure of Knowledge based system for group technology (KBSGT) – Data Baswe, Knowledge Base, Clustering Algorithm.

Text Book:

1. Yagna Narayana, ”Artificial Neural Networks”. PHI,2009.
2. Mikell P. Groover “Automation, Production Systems and Computer Integrated Manufacturing”, 8e, PHI,2008.

Reference Books:

1. Andre Kusaic,” Intelligent Manufacturing Systems” PHI,1989.

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COMPUTER AIDED PROCESS PLANNING

Course Code: 10ME2118

L	P	C
4	0	4

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.

UNIT - III

Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications.

UNIT – IV

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 –V

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.

UNIT –VI

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 –VII

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.

UNIT –VIII

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 Book:

1. Mikell P.Groover ,"Automation, Production systems and Computer Integrated Manufacturing",8e, PHI, 2008.
2. Dr.Sadhu Singh, "Computer Aided Design and manufacturing", Khanna publishers, 2000.

Reference Book:

1. Change T C & Richard A Wysk, "An Introduction to automated process planning systems", Prentice Hall 1985.

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COMPUTATIONAL FLUID DYNAMICS

Course Code: 10ME2119 **L P C**
4 0 4

UNIT – I

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

UNIT – II

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 – III

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 – IV

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

UNIT – V

Treatment of compressible flows: potential equation, Eluer equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT – VI

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

UNIT – VII

Standard variational methods - 1: Linear fluid flow problems, steady state problems

UNIT – VIII

Standard variational methods – 2: Transient problems.

Text books:

1. T. J.Chung, "Computational fluid dynamics", 1e, Cambridge University press,2002.

Reference Books:

1. T Frank Chorlton ,"Text book of fluid dynamics,CBS Publishers & distributors, 1985.

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ADVANCED MANUFACTURING TECHNOLOGY

Course Code: 10ME2120

L	P	C
4	0	4

UNIT I

Theory of Metal Cutting: Mechanism of metal cutting – Orthogonal and Oblique cutting, derivation of equations for forces and shear angles etc., various shear angle theories.

UNIT II

Tool materials – Tool life and tool wear – Temperature in metal cutting – Cutting fluids and surface roughness.

UNIT III

Special Machining: Deep hole drilling – Gun drills – Gun boring – Trepanning – Honing – Lapping – Super finishing – AFM – MAF – Burnishing – Broaching – Hard machining – Hot machining.

UNIT IV

High Speed Machining: The high performance machining of components – Application of HSM – Tools for HSM - Design of tools for HSM – High speed and high performance grinding – Ultra precision machining.

UNIT V

Non-traditional Machining-1: Introduction – USM, WJM, AWJM, LBM, EBM, Plasma machining and Hybrid machining processes – Mechanism of metal removal, characteristic features and applications.

UNIT VI

Non-traditional Machining-2: Mechanism of metal removal, characteristic features and applications of Electro-Discharge Machining

(EDM) and Electro-Chemical Machining (ECM).

UNIT VII

Micro Machining: Importance of micro machining, various micro machining processes, application of micro machining in semi conductor IC technology, micro actuator and micro sensors – CVD, PVD and Ion implantation.

UNIT VIII

Rapid Prototyping (RP): Need for time compression in product development, Product development conceptual design, Prototype, Tooling, Applications of RP. Principles, process parameters and process details of Stereo lithography systems, Laser sintering systems, Fusion deposition modeling, and Laminated object manufacturing.

Text Books:

1. S.Kalpakjian and S.R.Schmid, "Manufacturing Engineering and Technology", 4e, Pearson Education., 2001.
2. Sen and Battacharya, "Theory of Metal Cutting", NCB Agency, 1984.
3. Mishra.P.K., "Non-conventional Machining", Narosa publishing house, 1997.
4. Ghosh A., "Rapid Protopyping: A Brief Introduction", Affiliated East West,

Reference Book:

1. Benedict G., "Non Traditional Manufacturing Processes", Marcel Dekker, 1987.
2. Boothroyd G. & Knight W.A., "Fundamentals of Metal Machining and Machine Tools",1e, Marcel Dekker, 1989.

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METROLOGY AND NON DESTRUCTIVE TESTING

Course Code: 10ME2121

L	P	C
4	0	4

UNIT I

Tool maker's microscope and its uses - collimators, optical projector - optical flats and their uses, interferometer. Measurement of flat surfaces - instruments used - straight edges - surface plates - optical flat and auto collimator.

UNIT II

Co-ordinate measuring machines - Universal measuring machine - Laser viewers for production profile checks - Image shearing microscope. Use of computers, Machine vision, Microprocessors in metrology.

UNIT III

Differences between surface roughness and surface waviness - Numerical assessment of surface finish - CLA, R_a, RMS Values, Rz values. Methods of measurement of surface finish - Profilograph - Talysurf.

UNIT IV

Liquid Penetrant Tests: Characteristics of liquid penetrants – different washable systems – Developers – applications.

UNIT V

Magnetic Particle Tests: Methods of production of magnetic fields- Principles of operation of magnetic particle test- Applications- Advantages and Limitations.

UNIT VI

Radiography: Sources of ray X-ray production-properties of γ and X-rays – film characteristics – exposure charts – contrasts – operational characteristics of x ray equipment – applications.

UNIT VII

Ultrasonic Techniques: Production of ultrasonic waves – different types of waves - general characteristics of waves – pulse echo method – A, B, C scans.

UNIT VIII

Acoustic Emission Techniques: Principles of acoustic emission techniques – Advantages and limitations - Instrumentation – Applications.

Text Books:

1. Jain R.K .,"Engineering Metrology",20e, Khanna Publishers, 2007
2. Barry Hull and Vernon John ,"Non Destructive Testing", Mac Milan, 1988

Reference Books:

1. "Metals Hand Book ",Vol. II ,American Society for Metals, 1976.
2 Progress in Acoustic Emission, Proceedings of 10th International Acoustic Emission Symposium, Japanese society for NDI, 1990.
3. Also www. ndt-ed.org / NDT Resource Center

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COMPUTER AIDED MANUFACTURING AND ROBOTICS LABORATORY

Course Code: 10ME2122

L	P	C
0	3	2

- Tool planning and selection of sequences of operations, tool setting on machine - Practice.
- Practice in G & M code based CNC programming for the use on a turning machine.
- Practice in G & M code based CNC programming for the use on a machining center / milling machine.
- Surface generation, Tool selection, NC code generation and Tool path simulation for turning and milling operations using CAM packages like Master CAM / Pro-E.
- Operation of a CNC turning machine.
- Operation of a CNC milling machine.
- Practice in Robot programming and its languages.
- Robotic simulation using software – Robo- path control.
- Forward and Inverse kinematics of simple planar robotic manipulators.
- Inverse dynamics of simple planar robotic manipulators.