HINDUSTAN UNIVERSITY

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

(Estd. u/s 3 of the UGC Act, 1956)

Padur, Kancheepuram District - 603 103.

DEPARTMENT OF
MECHANICAL ENGINEERING

Regulations Curriculum and Syllabus 2013

M.Tech.
COMPUTER AIDED DESIGN

ACADEMIC REGULATIONS
(M.TECH./ M.B.A. / M.C.A.) (Full - Time / Part - Time)
(Effective 2013-14)

1. Vision, Mission and Objectives

1.1 The Vision of the Institute is "To make every man a success and no man a failure".

In order to progress towards the vision, the Institute has identified itself with a mission to provide every individual with a conducive environment suitable to achieve his / her career goals, with a strong emphasis on personality development, and to offer quality education in all spheres of engineering, technology, applied sciences and management, without compromising on the quality and code of ethics.

1.2 Further, the institute always strives

- To train our students with the latest and the best in the rapidly changing fields of Engineering, Technology, Management, Science & Humanities.
- To develop the students with a global outlook possessing, state of the art skills, capable of taking up challenging responsibilities in the respective fields.
- To mould our students as citizens with moral, ethical and social values so as to fulfill their obligations to the nation and the society.
- To promote research in the field of science, Humanities, Engineering, Technology and allied branches.

1.3 Our aims and objectives are focused on

- Providing world class education in engineering, technology, applied science and management.
- Keeping pace with the ever changing technological scenario to help our students to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and nation.
- To inculcate a flair for research, development and entrepreneurship.

2. Admission

2.1 The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, following guidelines issued by Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each branch of the (M.TECH / M.B.A. / M.C.A.) programme will be decided by BOM as per the directives from Ministry of Human Resource Development (MHRD), Government of India and taking into account the market demands. Some seats for Non Resident Indians and a few seats for foreign nationals shall be made available.

2.2 The selected candidates will be admitted to the (M.TECH / M.B.A. / M.C.A.) programme after he/she fulfills all the admission requirements set by the Institute and after payment of the prescribed fees.

2.3 Candidates for admission to the first semester of the Master's Degree Programme shall be required to have passed an appropriate Degree Examination recognized by Hindustan University.

2.4 In all matters relating to admission to the (M.TECH / M.B.A. / M.C.A.). Programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.

2.5 If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.

3. Structure of the programme

3.1 The programme of instruction will have the following structure

i) Core courses of Engineering / Technology / Management.

ii) Elective courses for specialization in areas of student's choice

3.2 The minimum durations of the programmes are as given below:

Program	No. of Semesters
M.Tech.(Full-Time)	4
M.Tech.(Part -Time)	6
M.B.A. (Full - Time)	4
M.B.A. (Part - Time)	6
M.C.A.(Full - Time)	6
M.C.A.(Part -Time)	8

Every (M.TECH / M.B.A. / M.C.A.) programme will have a curriculum and syllabi for the courses approved by the Academic Council.

3.3 Each course is normally assigned certain number of credits. The following norms will generally be followed in assigning credits for courses.

- One credit for each lecture hour per week per semester
- One credit for each tutorial hour per week per semester
- One credit for each laboratory practical of three hours per week per semester.
- One credit for 4 weeks of industrial training and
- One credit for 2 hours of project per week per semester.

3.4 For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below.

Program	Minimum prescribed credit range
M.Tech. (Full time / Part time)	75 - 85
M.B.A. (Full time / Part time)	85 - 95
M.C.A (Full time / Part time)	115 - 125

3.5 The medium of instruction, examination and the language of the project reports will be English.

4. Faculty Advisor

4.1 To help the students in planning their courses of study and for getting general advice on the academic programme, the concerned Department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor.

5. Class Committee

5.1 A Class Committee consisting of the following will be constituted by the Head of the Department for each class:

(i) A Chairman, who is not teaching the class.

(ii) All subject teachers of the class.

(iii) Two students nominated by the department in consultation with the class.

The Class Committee will meet as often as necessary, but not less than three times during a semester.

The functions of the Class Committee will include:

(i) Addressing problems experienced by students in the classroom and the laboratories.

(ii) Analyzing the performance of the students of the class after each test and finding ways and means of addressing problems, if any.

(iii) During the meetings, the student members shall express the opinions and suggestions of the class students to improve the teaching / learning process.

6. Grading

6.1 A grading system as below will be adhered to.

Range of Marks	Letter Grade	Grade points
95-100	S	10
85 - 94	A	09
75- 84	B	08
65-74	C	07
55-64	D	06
50-54	E	05
< 50	U	00
	I (Incomplete)	–

6.2 GPA & CGPA

GPA is the ratio of the sum of the product of the number of credits C_i of course "i " and the grade points P_i earned for that course taken over all courses "i" registered by the student to the sum of Ci for all "i ". That is,

$$GPA = \frac{\sum_i C_i P_i}{\sum_i C_i}$$

CGPA will be calculated in a similar manner, at any semester, considering all the courses enrolled from first semester onwards.

6.3 For the students with letter grade I in certain subjects, the same will not be included in the computation of GPA and CGPA until after those grades are converted to the regular grades.

6.4 Raw marks will be moderated by a moderation board appointed by the Vice-Chancellor of the University. The final marks will be graded using an absolute grading system. The Constitution and composition of the moderation board will be dealt with separately.

7. Registration and Enrollment

7.1 Except for the first semester, registration and enrollment will be done in the beginning of the semester as per the schedule announced by the University.

7.2 A student will be eligible for enrollment only if he/she satisfies regulation 10 (maximum duration of the programme) and will be permitted to enroll if (i) he/she has cleared all dues in the Institute, Hostel & Library up to the end of the previous semester and (ii) he/she is not

debarred from enrollment by a disciplinary action of the University.

7.3 Students are required to submit registration form duly filled in.

8. Registration requirement

8.1 **(i)** A Full time student shall not register for less than 16 credits or more than 26 credits in any given semester.

8.1 **(ii)** A part time student shall not register for less than 10 credits or more than 20 credits in any given semester.

8.2 If a student finds his/her load heavy in any semester, or for any other valid reason, he/she may withdraw from the courses within three weeks of the commencement of the semester with the written approval of his/her Faculty Advisor and HOD. However the student should ensure that the total number of credits registered for in any semester should enable him/her to earn the minimum number of credits per semester for the completed semesters.

9. Minimum requirement to continue the programme

9.1 For those students who have not earned the minimum required credit prescribed for that particular semester examination, a warning letter to the concerned student and also to his parents regarding the shortage of his credit will be sent by the HOD after the announcement of the results of the university examinations.

10. Maximum duration of the programme

The minimum and maximum period for the completion of various programs are given below.

Program	Min. No. of Semesters	Max. No. of Semesters
M.Tech (Full - time)	4	8
M.Tech (Part - time)	6	10
M.B.A. (Full Time)	4	8
M.B.A. (Part Time)	6	10
M.C.A. (Full - Time)	6	12
M.C.A (Part -Time)	8	14

11. Temporary discontinuation

11.1 A student may be permitted by the Director(academic) to discontinue temporarily from the programme for a semester or a longer period for reasons of ill health or other valid reasons. Normally a student will be permitted to discontinue from the programme only for a maximum duration of two semesters.

12. Discipline

12.1 Every student is required to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

12.2 Any act of indiscipline of a student reported to the Director (Academic) will be referred to a Discipline Committee so constituted. The Committee will enquire into the charges and decide on suitable punishment if the charges are substantiated. The committee will also authorize the Director(Academic) to recommend to the Vice-Chancellor the implementation of the decision. The student concerned may appeal to the Vice-Chancellor whose decision will be final. The Director (Academic) will report the action taken at the next meeting of the Council.

12.3 Ragging and harassment of women are strictly prohibited in the University campus and hostels.

13. Attendance

13.1 A student whose attendance is less than 75% is not eligible to appear for the end semester examination for that semester. The details of all students who have attendance less than 75% will be announced by the teacher in the class. These details will be sent to the concerned HODs and Director (Academic).

13.2 Those who have less than 75% attendance will be considered for condonation of shortage of attendance. However a condonation of 10% in attendance will be given on medical reasons. Application for condonation recommended by the Faculty Advisor, concerned faculty member and the HOD is to be submitted to the Director (Academic) who, depending on the merits of the case, may permit the student to appear for the end semester examination. A student will be eligible for this concession at most in two semesters during the entire degree programme. Application for medical leave, supported by medical certificate with endorsement by a Registered Medical Officer, should reach the HOD within seven days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier.

13.3 As an incentive to those students who are involved in extra curricular activities such as representing the University in Sports and Games, Cultural Festivals, and Technical Festivals, NCC/ NSS events, a relaxation of up to 10% attendance will be given subject to the condition that these students take prior approval from the officer-in-charge. All such applications should be recommended by the concerned HOD and forwarded to Director (Academic) within seven instructional days after the programme/activity.

14. Assessment Procedure

14.1 The Academic Council will decide from time to time the system of tests and examinations in each subject in each semester.

14.2 For each theory course, the assessment will be done on a continuous basis as follows:

Test / Exam	Weightage	Duration of Test Exam
First Periodical Test*	10%	2 Periods
Second Periodical Test*	10%	2 Periods
Model exam	20%	3 hours
Seminar/ Assignments/Quiz	20%	
End - semester examination	50%	3 Hours

*** Best out of the two tests will be considered.**

14.3 For practical courses, the assessment will be done by the subject teachers as below:

(i) Weekly assignment/Observation note book / lab records - weightage 60%.

(ii) End semester examination of 3 hours duration including viva - weightage 40%

15. Make up Examination/model examination

15.1 Students who miss the end-semester examinations / model examination for valid reasons are eligible for make-up examination /model examination. Those

who miss the end-semester examination / model examination should apply to the Head of the Department concerned within five days after he / she missed examination, giving reasons for absence.

15.2 Permission to appear for make-up examination / model exam will be given under exceptional circumstances such as admission to a hospital due to illness. Students should produce a medical certificate issued by a Registered Medical Practitioner certifying that he/she was admitted to hospital during the period of examination / model exam and the same should be duly endorsed by parent / guardian and also by a medical officer of the University within 5 days.

16. Project evaluation

16.1 For Project work, the assessment will be done on a continuous basis as follows:

Review / Examination	Weightage
First Review	10%
Second Review	20%
Third Review	20%
End semester Examination	50%

For end semester exam, the student will submit a Project Report in a format specified by the Director (Academic). The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end - semester examination will be conducted by a Committee constituted by the Controller of Examinations. This will include an external expert.

17. Declaration of results

17.1 A candidate who secures not less than 50% of total marks prescribed for a course with a minimum of 50% of the marks prescribed for the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

17.2 After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of PG programmes constituted by the Vice-Chancellor. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee of the Academic Council constituted by the Chancellor for scrutiny. The minutes of the Standing Sub Committee along with the results are to be placed before the Vice-Chancellor for approval. After getting the approval of the Vice-Chancellor, the results will be published by the Controller of Examination/ Registrar.

17.3 If a candidate fails to secure a pass in a course due to not satisfying the minimum requirement in the end semester examination, he/she shall register and re-appear for the end semester examination during the following semester. However, the sessional marks secured by the candidate will be retained for all such attempts.

17.4 If a candidate fails to secure a pass in a course due to insufficient sessional marks though meeting the minimum requirements of the end semester examination, wishes to improve on his/ her sessional marks, he/she will have to register for the particular course and

attend the course with permission of the HOD concerned and the Registrar. The sessional and external marks obtained by the candidate in this case will replace the earlier result.

17.5 A candidate can apply for the revaluation of his/her end semester examination answer paper in a theory course within 2 weeks from the declaration of the results, on payment of a prescribed fee through proper application to the Registrar/Controller of Examinations through the Head of the Department. The Registrar/ Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

17.6 The weightage for internal marks in finalizing results and grades shall be waived off after completion of 5 semesters.

18. Grade Card

18.1 After results are declared, grade sheet will be issued to each student, which will contain the following details:

(i) Program and branch for which the student has enrolled.

(ii) Semester of registration.

(iii) List of courses registered during the semester and the grade scored.

(iv) Semester Grade Point Average (GPA)

(v) Cumulative Grade Point Average (CGPA).

19. Class / Division

19.1 Classification is based on CGPA and is as follows:

CGPA $\geq$ 8.0 : **First Class with distinction**

6.5 $\leq$ CGPA < 8.0 : **First Class**

5.0 $\leq$ CGPA < 6.5 : **Second Class.**

19.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance within the minimum duration of the programme.

(ii) The award of 'First Class' is further subject to the candidate becoming eligible to the award of the degree having passed the examination in all the courses within the below mentioned duration of the programme.

Program	No. of Semesters
M.Tech.(Full-Time)	5
M.Tech.(Part -Time)	7
M.B.A. (Full - Time)	5
M.B.A. (Part - Time)	7
M.C.A.(Full - Time)	7
M.C.A.(Part -Time)	9

(iii) The period of authorized discontinuation of the programme (vide clause 11.1) will not be counted for the purpose of the above classification.

20. Transfer of credits

20.1 Within the broad framework of these regulations, the Academic Council, based on the recommendation of the transfer of credits committee so constituted by the Chancellor may permit students to earn part of the credit requirement in other approved institutions of repute and status in the country or abroad.

21. Eligibility for the award of (M.TECH / M.B.A. / M.C.A.) Degree

21.1 A student will be declared to be eligible for the award of the (M.TECH / M.B.A. / M.C.A.). Degree if he/she has

i) registered and successfully credited all the core courses,

ii) successfully acquired the credits in the different categories as specified in the curriculum corresponding to the discipline (branch) of his/her study within the stipulated time,

iii) has no dues to all sections of the Institute including Hostels, and

iv) has no disciplinary action pending against him/her.

The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

22. Power to modify

22.1 Notwithstanding all that has been stated above, the Academic Council has the right to modify any of the above regulations from time to time subject to approval by the Board of Management.

HINDUSTAN UNIVERSITY
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M.TECH. - COMPUTER AIDED DESIGN

SEMESTER - I

Sl.No.	Course	Course Title	L	T	P	C	TCH
THEORY							
1	PMA 101	Advanced Engineering Mathematics	4	0	0	4	4
2	PCD 101	Computer Aided Graphics	4	0	0	4	4
3	PCD 102	Finite Element Methods	4	0	0	4	4
4	PCD 103	Integrated Mechanical Design	4	0	0	4	4
5	PCD 104	Concept of Engineering Design	4	0	0	4	4
6	PCD 105	Advanced Strength of Materials	4	0	0	4	4
PRACTICAL							
7	PCD 151	CAD Lab	0	0	3	1	3
		Total				**25**	**27**

SEMESTER - II

Sl. No	Course	Course Title Code	L	T	P	C	TCH
THEORY							
1	PCD 201	Optimization in Engineering Design	4	0	0	4	4
2	PCD 202	Mechanical Vibrations	3	0	2	4	5
3	PCD 203	Metallic Materials & Manufacturing Processes	4	0	0	4	4
4	-	Elective - I*	4	0	0	4	4
5	-	Elective - II*	4	0	0	4	4
6	-	Elective - III*	4	0	0	4	4
PRACTICAL							
7	PCD 251	Analysis & Simulation Lab	0	0	3	1	3
8	PCD 252	Design Project	0	0	6	2	6
		Total				**27**	**34**

SEMESTER - III

Sl. No	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	-	Elective - IV*	4	0	0	4	4
2	-	Elective - V*	4	0	0	4	4
3	-	Elective - VI*	4	0	0	4	4
4	PCD 351	Practical Industrial Training and viva voce (during Previous semester vacation)	-	-	-	1	-
PRACTICAL							
5	PCD 352	Project Work Phase - I	0	0	12	6	12
		Total				**19**	**24**

SEMESTER - IV

Sl. No	Course Code	Course Title Code	L	T	P	C	TCH
PRACTICAL							
1	PCD 451	Project Work Phase - II	0	0	24	12	24
		Total				**12**	**24**

Elective courses

Sl. No	Course	Course Title Code	L	T	P	C	TCH
THEORY							
1	PCD 701	Model Analysis of Mechanical Systems	4	0	0	4	4
2	PCD 702	Rapid Prototyping & Tooling	4	0	0	4	4
3	PCD 703	Tribology in Design	4	0	0	4	4
4	PCD 704	Design of Fluid Power Systems	4	0	0	4	4
5	PCD 705	Integrated Product & ProcessesDevelopment	4	0	0	4	4
6	PCD 706	Composite Material & Mechanics	4	0	0	4	4
7	PCD 707	Engineering System Dynamics	4	0	0	4	4
8	PCD 708	Advanced Tool Design	4	0	0	4	4
9	PCD 709	Design for Manufacture, Assembly & Environments	4	0	0	4	4
10	PCD 710	Plasticity & Metal Forming	4	0	0	4	4
11	PCD 711	Vibration Control & Condition Monitoring	4	0	0	4	4
12	PCD 712	Industrial Robotics and Expert Systems	4	0	0	4	4
13	PCD 713	Enterprise Resource Planning	4	0	0	4	4
14	PTE701	Computational Fluid Dynamics	4	0	0	4	4
15	PCD 714	Computer Application Design	4	0	0	4	4
16	PCD 715	Computer Integrated Manufacturing	4	0	0	4	4
17	PTE103	Advanced Fluid mechanics	4	1	0	4	5
18	PCD 716	Non - destructive testing methods	4	0	0	4	4
19	PCD 717	Machine Tool control and Condition Monitoring	4	0	0	4	4
20	PCD 718	Failure Analysis	4	0	0	4	4
21	PTE 709	Quantitative and Qualitative Research	4	0	0	4	4

* Student is permitted to choose an elective from other programmes. The electives may include the core subjects offered by other programmes.

Semester wise Credits

Semester I **25**

Semester II **27**

Semester III **19**

Semester IV **12**

Total Credits **83**

SEMESTER - I

PMA101 - ADVANCED ENGINEERING MATHEMATICS
[Common to M.Tech (Aero/Mech/Auto/CAD/Thermal/R&AC and IC Engine)]

L	T	P	C
3	1	0	4

Goal

Develop the Mathematical skills to formulate certain practical problems, solve them analytically and numerically and to interpret the results.

Objectives

The course should enable the student to

1. Understand the functional and the concepts of calculus of variation and its properties. Learn techniques to find the extremals of the variational problems involving one many unknown functions, functional dependent on higher order derivatives and isoperimetric problems.
2. Learn to classify the initial and boundary value problems. Understands the D'Alemberts solution of the one dimensional wave equation. Understand the Fourier transform techniques for solving heat flow problems in infinite and semi infinite rod.
3. Learn Harmonic functions and their properties. Understands solving the Laplace equation using Fourier transforms in a half plane with infinite strip and in a semi infinite strip.
4. Understand to classify the partial differential equations. Learn the methods of solving second order partial differential equations numerically.
5. Understands mapping and learns the concept of conformal mapping by doing the transformation from z plane to w plane

Outcomes

The students should be able to:

1. Able to find the extremals of the functional of different types and uses their technique to find the geodesic and solves isoperimetric problems. Using direct method finds the approximate solution and compares with the exact solutions using Ritz and Kantorovich methods.
2. Able to form the wave equations with initial conditions and solve them using D'Alemberts solutions. Solves the wave equations using Laplace transform for displacements in long string - long string under its weight and free and forced vibrations. Applies Fourier transform techniques for solving the heat flow problems with infinite and semi infinite rods.
3. Able to find the steady state temperature by solving the Laplace equation using Fourier transform techniques. Solves the heat flow problems in a half plane with infinite strip and in a semi infinite strip.
4. Able to solve the initial and boundary value problems related heat flow, both one and two dimensional and vibration problems and obtains their numerical solutions. Understands the numerical techniques of solving the partial differential equation in engineering applications.
5. Applies conformal mapping to fluid and heat flow problems.

UNIT I CALCULUS OF VARIATIONS **12**

Concept of variation and its properties- Euler's Equation-Functional dependant on first and higher order derivatives - Functional dependant on functions of several independent variables- Isoperimetric problems - Direct methods-Ritz and Kantrovich methods

UNIT II TRANSFORM METHODS **12**

Laplace transform methods for one dimensional wave equation - Displacements in a long string - Longitudinal vibration of an elastic bar - Fourier Transform methods for one dimensional heat conduction problems in infinite and semi-infinite rod

UNIT III ELLIPTIC EQUATIONS **12**

Laplace equation - Properties of Harmonic functions - Solutions of Laplace equation by means of Fourier transform in a half plane in an infinite strip and in a semi-infinite strip

UNIT IV NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS **12**

Solution of Laplace and Poisson equation on a rectangular region by Lieebmann's method - Diffusion equation by the explicit and Crank Nicolson - Implicit methods - Solution of wave equations by explicit scheme Cubic spline interpolation

UNIT V CONFORMAL MAPPING AND APPLICATIONS **12**

The Schwarz - Christoffel transformation - Transformation of boundaries in parametric form - Physical applications - Application to fluid and heat flow.

Total - 60

REFERENCES

1. Gupta A.S., "Calculus of Variations with Applications", Prentice Hall of India(P) Ltd., New Delhi, 6th print, 2006
2. Sankar Rao K. - "Introduction to Partial Differential Equations", Prentice Hall of India(P) Ltd., New Delhi, 5th print, 2004
3. Jain R.K, and Iyengar S.R.K., - "Advanced Engineering Mathematics", Narosa publications 2nd Edition, 2006
4. Grewal, B.S - "Numerical Methods in Science and Engineering", Kanna Publications, New Delhi.
5. Kandasamy P., Thilagavathy. K and Gunavathy, K - "Numerical Methods", S Chand and Co. , Ltd., New Delhi, 5th Edition, 2007
6. Spiegel M. R., "Theory and problems of Complex Variables with an Introduction to Conformal Mapping and Its applications", Schaum's outline series, Mc Graw Hill Book Co., 1987.

PCD101 - COMPUTER AIDED GRAPHICS

L	T	P	C
4	0	0	4

Goal

To introduce the concepts of geometric modeling and three dimensional computer graphics To introduce the application concepts of three dimensional modeling

Objectives

The course should enable the students to:

1. To impart the knowledge on viewing transformations and algorithms
2. Understand the concepts of graphics and omputing standards
3. Understand the concepts related to the applications of modeling.

Outcome

The students should be able to:

1. Gain the knowledge on various transformations
2. Develop the on surface and solid modeling
3. Write algorithms related to 2D and 3D graphics.

UNIT I INTRODUCTION **11**

Output primitives - Line drawing algorithm - Circles and other curves - Attributes of output - primitives - 2D, 3D transformations - Translation, Rotation, Scaling - Concatenation.

UNIT II TECHNIQUES FOR GEOMETRIC MODELING **15**

Representation of curves - Bezier curves - cubic spline curve - B - Spline curves - Rational curves - Surface Modeling techniques - surface patch - Coons patch- bi-cubic patch - Bezier and B-spline surfaces - Volume modeling - Boundary models - CSG- other modeling techniques.

UNIT III THREE DIMENSIONAL COMPUTER GRAPHICS **13**

Viewing transformations - perspective projection- techniques for visual realism - hidden line - Surface removal - Algorithms for shading and Rendering.

UNIT IV GRAPHICS STANDARDS FOR CAD **11**

Graphics and computing standards - GKS - Bitmaps - Open GL Data Exchange standards - IGES - STEP - CALS - DXF - Communication standards - WAN - LAN.

UNIT V 3D MODELING APPLICATIONS AND SPECIAL TO TOPICS **10**

2D Representations - Development of surfaces - Integration of design Analysis and CAD - Graphical aid for preprocessing in FEA - mesh generation techniques - Post processing - Machining from 3D Model - generative machining - cutter location - gouge detection - tool path generation from solid models - STL formats - for rapid prototyping - Slicing techniques - Introduction to fractional geometry.

Total : 60

REFERENCES

1. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 2nd edition 2009.
2. Ibrahim Zeid "CAD/CAM - Theory and Practice" - McGraw Hill International Edition, 2nd Edition , 2009.
3. Chris McMohan and Jimmi Browne, " CAD/CAM principles, practice and manufacturing management, Pearson Education Asia, Ltd., 2000.

WEB REFERENCES:

1. www.cadcamnet.com
2. www.cc.utah.edu/~asn8200/rapid.html

PCD102 - FINITE ELEMENT METHODS

L	T	P	C
4	0	0	4

Goal

To teach the fundamentals of finite element method with emphasize on the underlying theory, assumption, and modelling issues as well as providing hands on experience using finite element software to model, analyze and design systems of mechanical and aerospace engineers.

Objectives

The course should enable the students to:

1. Equip the students with the Finite Element Analysis fundamentals.
2. Formulate the design problems into FEA.
3. 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.
4. Understand the importance of verification and validation of finite element computations.

Outcome

The students should be able to:

1. Solve ordinary and partial differential equations using the Galerkin method.
2. Develop the finite element equations to model engineering problems governed by 2nd, 3rd and 4th order ordinary differential equations..
3. Apply finite element techniques to formulate and solve structural, fluid, and thermal problems using finite element methodology.
4. Derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts.

UNIT I INTRODUCTION **13**

Relevance of finite element analysis in design - Modeling and discretization Interpolation, elements, nodes and degrees-of-freedom-applications of FEA

One-Dimensional Elements and Computational Procedures: Bar element - beam element - bar and beam elements of arbitrary orientation - assembly of elements - properties of stiffness matrices-boundary conditions-solution of equations-mechanical loads and stresses-thermal loads and stresses-example problems.

UNIT II BASIC ELEMENTS **13**

Interpolation and shape functions - element matrices-linear triangular elements (CST)-quadratic triangular elements - bilinear rectangular elements-quadratic rectangular elements-solid elements-higher order elements-nodal loads-stress calculations-example problems.

UNIT III ISOPARAMETRIC ELEMENTS **11**

Introduction-bilinear quadrilateral elements - quadratic quadrilaterals - hexahedral - isoparametric - elements - Numerical Integration - quadrature - static condensation - load considerations - stress calculations - examples of 2D and 3D applications.

UNIT IV FINITE ELEMENTS IN STRUCTURAL DYNAMICS APPLICATIONS **12**

Dynamic equations - mass and damping matrices - natural frequencies and modes - damping - reduction of number of degrees-of-freedom-response history - model methods - Ritz vectors - component mode synthesis - harmonic response - direct integration techniques - explicit and implicit methods - analysis by response spectra - example problems.

UNIT V HEAT TRANSFER AND FLUID MECHANICS APPLICATIONS **11**

Heat transfer - element formulation - radiation-nonlinear problems-transient thermal analysis-acoustic frequencies and modes-fluidstructure interaction problems-plane incompressible and rotational flows-example problems.

Total 60

REFERENCES:

1. Reddy J.N. An Introduction to the Finite Element Method, McGraw Hill, International Edition, 3rd Edition 2010..
2. Segerlind L.J., "Applied Finite Element Analysis", John Wiley & Sons, 1984
3. Chandrupatla & Belagundu, "Finite Elements in Engineering", Prentice Hall of India Private Ltd., 3rd Edition 2009.
4. George R Buchaman , " Schaum's Outline of Finite Element Analysis", McGraw Hill Company 2004.
5. S.S.Rao, Finite Element Analysis, 2002 Edition.
6. Cook, Robert Davis et al "Concepts and Applications of Finite Element Analysis", John Wiley & Sons, 4th Edition 2007.

WEB REFERENCES:

1. http://www.vector-space.com/
2. http://www.mech.port.ac.uk/sdalby/mbm/CTFRProg.htm

PCD103 - INTEGRATED MECHANICAL DESIGN

L	T	P	C
4	0	0	4

Goal

To teach the fundamentals of machine elements which emphasize on the underlying theory, assumption, and modeling issues as well as providing hands on experience using finite element software to model, analyze and design systems of mechanical engineers.

Objectives

The course should enable the students to:

1. To equip the students with the machine design fundamentals and the phases of design.
2. To enable the students to understand the machine elements such as shaft,gear, clutch etc..
3. To introduce basic concepts of machine design.

Outcome

The students should be able to:

1. Design the machine element.
2. Develop the concepts.
3. Apply their new concept to optimize the Design.
4. Understand the importance of machine design this will lead the students to innovation.

UNIT I INTRODUCTION **10**

Phases of design - Standardization and interchangeability of machine elements - Tolerances from process and function - Individual and group tolerances - Selection of fitsfor different design situations - Design for assembly and modular constructions - Concepts of integration.

UNIT II SHAFTING **10**

Analysis and Design of shafts for different applications - detailed design - preparation of production drawings - integrated design of shaft, bearing and casing - design for rigidity.

UNIT III GEARS AND GEAR BOXES **20**

Principles of gear tooth action - Gear correction - Gear tooth failure modes - Stresses and loads - Component design of spur, helical, bevel and worm gears - Deign for sub assembly - Integrated design of speed reducers and multispeed gear boxes - application of software packages.

UNIT IV CLUTCHES **10**

Integrated design of automobile clutches and over running clutches.

UNIT V BRAKES **10**

Dynamics and thermal aspects of vehicle braking - Integrated design of brakes for machine tools, automobiles and mechanical handling equipments.

Total : 60

REFERENCES:

1. Newcomb, T.P. and Spur, R.T., "Automobile Brakes and Braking Systems", Chapman and Hall, 2nd Edition, 1975.
2. Juvinall, RL.C., "Fundamentals of Machine Component Design", John Wiley, 1999.
3. Maitra G.M., "Hand Book of Gear Design", Tata McGraw Hill, 1985.
4. Shigley, J.E., "Mechanical Engineering Design", McGraw Hill, 6th Edition 2010.
5. Tech. P.S.G., "Design Data Book", Kalaikathir Achchagam, Coimbatore, 2003.
6. Lingaiah. K. and Narayana Iyengar, "Machine Design Data Hand Book", Vol. 1 & 2, Suma Publishers, Bangalore, 1983

WEB REFERENCES:

1. http://agma.org/

PCD104 - CONCEPT OF ENGINEERING DESIGN

L	T	P	C
4	0	0	4

Goal

To introduce the concepts of design process, tools used in design methods, and knowledge on material selection, reliability and understanding of DFM/DFA , Legal and ethical issues in design and quality engineering.

Objectives

The course should enable the students to:

1. Widen students knowledge on design process
2. Enable Students to attain knowledge on tools used in Design Methods
3. Create an understanding on the process of material selection and design
4. Develop in depth knowledge on Engineering statistics and reliability
5. Create awareness on legal and ethical issues in Design an Quality Engineering.

Outcome

The students should be able to:

1. Get clear understanding on CAE / concurrent engineering and systems engineering
2. Attain problem solving skills through modeling/simulation and optimize design

3. Ability to do material selection based on economy and value analysis. Develop understanding on DFM/DFA

4. Have good understanding on DOE, Reliability theory and reliability centered maintenance

5. Exposed to laws, codes of ethics, Quality concepts and FMEA

UNIT I DESIGN PROCESS **12**

The design process - Morphology of Design - Design Drawings - Computer Aided Engineering - Designing of standards - Concurrent Engineering - Product life cycle - Technological Forecasting - Market Identification- Competition Bench marking - Systems Engineering - Life Cycle Engineering - Human Factors in Design - Industrial Design.

UNIT II DESIGN METHODS **12**

Creativity and Problem Solving - Product Design Specifications- Conceptual design -Decision Theory - Decision Tree - Embodiment Design - Detail Design - Mathematical Modeling - Simulation - Geometric Modeling - Finite Element Modeling - Optimization - Search Methods - Geometric Programming - Structural and Shape Optimization.

UNIT III MATERIAL SELECTION PROCESSING AND DESIGN **12**

Material Selection Process - Economics - Cost Vs Performance - Weighted property Index -Value Analysis - Role of Processing in Design - Classificationof Manufacturing Process - Design for Manufacture - Design for Assembly -Designing for castings, Forging, Metal Forming, Machining and Welding - Residual Stresses - Fatigue, Fracture and Failure.

UNIT IV ENGINEERING STATISTICS AND RELIABILITY **12**

Probability - Distributions - Test of Hypothesis - Design of Experiments - Reliability Theory - Design for Reliability - Reliability centered Maintenance.

UNIT V LEGAL AND ETHICAL ISSUES IN DESIGN AND QUALITY ENGINEERING **12**

Introduction - The origin of laws - Contracts - Liability - Tort law - Product liability - Protecting intellectual property - Legal and ethical domains - Codes of ethics - Solving ethical conflicts- case studies

Total Quality Concept - Quality Assurance - Statistics Process Control - Taguchi Methods - Robust Design - Failure Model Effect Analysis. **Total : 60**

REFERENCES:

1. Pahl, G, and Beitz, W.," Engineering Design", Springer - Verlag, NY. 1984.

2. Ray, M.S., "Elements of Engg. Design", Prentice Hall Inc. 1985.

   Suh, N.P., "The principles of Design", Oxford University Press, NY.1990.

3. Dieter, George E., Engineering Design - "A Materials and Processing Approach", McGraw Hill International Editions, Singapore,3rd Edition, 2000.

4. Dieter, George E., Engineering Design - "A Materials and Processing Approach", McGraw Hill International Editions, Singapore,3rd Edition, 2000.

5. Karl T. Ulrich and Steven D. Eppinger "Product Design and Development" McGraw Hill Edition 4th edition 2009 Karl T. Ulrich and Steven D. Eppinger "Product Design and Development" McGraw Hill Edition 4th edition 2009.

PCD 105 - ADVANCED STRENGTH OF MATERIALS

L	T	P	C
4	0	0	4

Goal

To make the students to understand the advanced concepts and techniques of strength of materials, both theoretical and experimental, with emphasis on the application of these to the solution of suitable problems in engineering. Provide advanced concepts for better understanding of complicated design problems.

Objectives

The course should enable the students to

1. Gain knowledge of stresses, strains and deformations in three dimensions.
2. Understand the concepts of unsymmetrical bending and the shear flow.
3. Provide knowledge on stresses and deformations in the curved beams and plates through mathematical models.
4. Understand the concept of torsion of non-circular sections.
5. Provide the knowledge on the stresses induced in the solid discs and ring due to rotation.

Outcome

The students should be able to

1. Use the concepts of conditions of equilibrium and compatibility equations and the plane stress.
2. Assess the stresses and the deflection of curved flexural members like chain links and crane hooks.
3. Apply the effect of stress, strains and deformations of flat circular and rectangular plates.
4. Asses the effect of twisting of non-circular sections and torsional shear stresses in the thin walled sections.
5. Asses the radial and tangential stresses in the solid discs and rings subjected to rotation.

UNIT I ELASTICITY **11**

Stress strain relations and general equations of elasticity in Cartesian, Polar and Spherical coordinates differential equations of equilibrium - Compatatibility - boundary conditions - representation of 3 - dimensional stress of a tensor - Generalized Hooke's law - St. Venant's principle - plane strain - plane stress - Airy's stress function.

Shear Center: Location of Shear center for various sections - shear flows.

Unsymmetrical Bending: Stresses and deflectionsin beams subjected to unsymmetrical loading - Kern of a section.

UNIT II CURVED FLEXURAL 11

Circumferential and radial stresses- deflections- curved beam with restrained ends-closed ring subjected to concentrated load and uniform load chain links and crane hooks.

UNIT III STRESSES IN FLAT PLATES 11

Stresses in circular and rectangular plates due to various types of loading and end conditions -- buckling of plates and stress concentrations

UNIT IV TORISION OF NON - CIRCULAR SECTIONS 11

Torsion of rectangular cross sections-St. Venant's theory - Elastic membrane Analog:y-Prandtl's stress function-Torsional stresses in hollow thin-walled tubes.

UNIT V STRESSES DUE TO ROTATION 16

Radial and tangential stresses in solid disc and ring of uniform, thickness and varying thickness-allowable speeds. Theorr% of Contact Stresses: Methods of computing contact stresses - Deflection of bodies in point and line contact--Applications.

Total 60

REFERENCES:

I. Seely and smith, " Advanced Mechanics of materials" John tttiley International End, 2004.

2. Rimoahwnko, "Strength of Materials", Van Nostrand.

3. Den Hartong, "Advanced Strength of Materials" McGraw Hill. Book co, New york 1952.

4. Timoshenko and Goodier, `Theory of Elasticity", McGraw Hill. 5. Wang, "Applied Elasticity",. McGraw Hill, 1970.

6. Case, "Strength of Materials", Edward Arnold, London 1957.

7. Robert D. Cook, Warren C. Young, "Advanced Mechanics of Materials", Macmillan Pub. Co., 1952.

8. Durelli, Phillips & Tsc, "Analysis of Stress and Strain".

PCD 151 - CAD LAB

L	T	P	C
0	0	3	1

Goal

- To make students to understand and learn about design and development of various mechanical components using modelling software.
- To impart knowledge on all aspects of CAD industry.
- To provide quality education in the field of CAD recent developments

Objectives

The course should enable the students to:

1. Learn and for giving hand on experience of using modelling softwares like Pro-E, CATIA V6
2. Train them for solving problems in short duration.

Outcome

The students should be able to:

1. Present an overview of CADD and describe its applications in different fields.
2. Describe common terms associated with CADD hardware and software.
3. Outline the basic principles associated with CADD and to demonstrate common drafting techniques used by professionals.
4. Introduce the advanced capabilities of CADD and how they can be used to increase productivity.
5. Provide information about the CADD industry resources.

List of Excersices for CAD LAB:

Introduction to Computer Aided Drafting - Operating systems - Wire Frame - Surface and Solid Modeling - Simulation and Machining using CNC / DNC Machine Tools - Use of FEM Packages - Relational Data Base - Networking - Practice on Computer Aided Measuring Instruments - Image Processing - Software Development for Manufacturing - CNC Controllers - Use of advanced CNC Machining Packages - Business Data Processing.

Exercises in Modeling and Analysis of Mechanical Components and assembly using Parametric and Feature based packages like PRO-E/ SOLID WORKS / CATIA / NX/ ANSYS/NASTRAN etc.

Total : 45

Equipments for CAD Lab

1.	CAD Workstations	: 10Nos
2.	CAD, 3D Modeling Software with assembly, mechanism simulation and drafting modules	: 10 Nos
3.	CAM Software for tool path generation for planer machining, contour machining, drilling, turning etc. & post processing modulus for different CNC controllers	: 10 Nos
4.	Medium production type CNC turning center with popular industrial type controller	: 1
5.	Medium production type CNC machining center with popular industrial type controller	: 1
6.	Bench Model CMM	: 1
7.	Vision & image processing software	: 2
8.	Data Processing Software	: 2

PCD 201 - OPTIMIZATION IN ENGINEERING DESIGN

L	T	P	C
4	0	0	4

Goal

To make the students to understand the various concepts and techniques of optimization of linear and non-linear models, with emphasis on the application of these to the solution of various problems on design of machine elements. Provide a better understanding of design problems with optimization.

Objectives

The course should enable the students to

1. Gain knowledge of fundamentals and classification of various optimization techniques.
2. Understand the concepts of non-linear programming and various search methods.
3. Provide knowledge on geometric programming.
4. Understand the knowledge of optimization in designing of various machine elements.

Outcome

The students should be able to

1. Use the various techniques of optimization and provide an optimum solution to the problems involving the design of machine elements.
2. Discrete the type of problems and optimize as per the requirements.
3. Assess the search methods and provide local and/or global maxima or minima.
4. stresses and the deflection of curved flexural members like chain links and crane hooks.
5. Apply the knowledge of optimization in designing of various machine elements and systems. Pre-requisite knowledge in computer programming matrix theory and vector algebra.

UNIT I INTRODUCTION TO OPTIMIZATION 12

Introduction, definitionand historic development, engineering applications of optimization, Statement of an optimization problem, classificationof optimization problems, optimization techniques. Classical optimization techniques: single variable optimization, multivariable optimization with no constraints, multivariable optimization with equality constraints, multivariable optimization with unequality constraints. Linear Programming- I: Simplex method.

UNIT II NON-LINEAR PROGRAMMING 12

Nonlinear programming-I One Dimensional Minimization Methods: Introduction, Unimodal function-elimination methods: unrestricted search, Exhaustive search, Dichotomous search, Interval halving method Fibonacci method, and Golden section method. Interpolation methods: quadratic and cubic interpolation methods, direct root method.

Non-linear programming II - Unconstrained optimization techniques

Introduction : Direct search methods: Random search methods, univariate method, pattern search methods - Descent methods: Gradient of a function, steepest descent method, conjugate gradient

method, variable metric method.

UNIT III NON-LINEAR PROGRAMMING **12**

Non-linear programming III : Constrained optimization techniques

Introduction : Characteristics of a constrained problem - direct methods: Complex method, cutting plane method, methods of feasible directions - Indirect methods: transformation techniques, penalty function method, interior penalty function method, convex programming problems - exterior penalty function method.

UNIT IV GEOMETRIC PROGRAMMING **12**

Introduction, Posynomial - unconstrained minimization problem, solution of unconstrained geometric programming - problem using differential calculus and problem using arithmetic geometric inequality, constrained minimization - solution of constrained geometric programming problem. Primal and dual programs in the case of less-than inequalities. geometric programming with mixed inequality constraints, Complementary geometric programming, Applications of geometric programming.

UNIT V OPTIMUM DESIGN OF MACHINE ELEMENTS **12**

Functional requirements desirable and undesirable effects - functional requirements and material and geometrical parameters -adequate designs, optimum design - primary design equation, subsidiary design equations, limit equations basic procedural steps for methods of optimum design -- constrained parameters and free variables - normal, redundant and incompatible specifications -general planning.

Total 60

REFERENCES:

1. Roa, S.S., "Optimization ---- Theory and Applications", Wiley Eastern, New Delhi, 1978
2. Johnson, Ray c., "Optimum Design of Mechanical Elements", 2"d edition, John Wiley & Sons, Inc., New York, 1984.
3. Fox, R, L., "Optimization Methods for Engineering Design" Addison - Wesley. Reading. Mass, 1971.
4. Wilde, D.J., "Optimum Seeking Methods", Frentice-Hall, Englewood Cliffs, New Jersey, 1964.

PCD 202 - MECHANICAL VIBRATIONS

L	T	P	C
3	0	2	4

Goal

To expose the students to understand the sources of the vibration in automobile and other machinery and study the various methods to reduce the noise and vibration

Objectives

The course should enable the students to:

1. Understand the sources of vibration and noise in automobiles and make design modifications
2. Learn to reduce the vibration and noise and improve the life of the components

Outcome

The students should be able to:

1. Translate a physical problem in mechanical vibration to an appropriate mathematical model.
2. Make engineering judgement on the problem of reducing vibration when required and the role of vibration in the design of mechanical equipment.

UNIT I FUNDAMENTALS OF VIBRATION 15

Review of Single degree freedom systems - Response to arbitrary periodic Excitations - Duhamel's Integral - Impulse Response function - Virtual work - Lagrange's equation - Single degree freedom forced vibration with elastically coupled viscous dampers - System identification from frequency response - Transient Vibration - Laplace transformation formulation.

UNIT II TWO DEGREE FREEDOM SYSTEM 12

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

UNIT III MULTI-DEGREE FREEDOM SYSTEM 15

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

UNIT IV VIBRATION OF CONTINUOUS SYSTEMS 12

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

UNIT V EXPERIMENTAL METHODS IN VIBRATION ANALYSIS 21

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

Total : 75

REFERENCES

1. Thomson, W.T. - "Theory of Vibration with Applications", CBS Publishers and Distributors, New Delhi, 3rd Edition 2002..
2. Rao, J.S., & Gupta, K. - "Ind. Course on Theory and Practice Mechanical Vibration", New Age International (P) Ltd., 1984.
3. Den Hartog, J.P, " Mechanical Vibrations," Dover Publications, 1990.
4. Rao, S.S.," Mechanical Vibrations," Addison Wesley Longman, 4th Edition 2007.

WEB REFERENCES

1. http://www.ecgcorp.com/velav/

2. http://www.auburn.edu/isvd/

3. www.vibetech.com/techpaper.htm

PCD 203 - METALLIC MATERIALS & MANUFACTURING PROCESSES

L	T	P	C
4	0	0	4

Goal

- To impart in depth knowledge of the various composite materials and their components like fibres, matrix materials and their behaviour in the manufacturing and testing processes.
- To predict the failures of composites when subjected to various forms of stresses using NDT methods and quality evaluation.

Objectives

The course should enable the students to:

1. Study the types of fibres and their structure and behaviours
2. Study the mathematical analysis of stresses acting on the composites
3. Expose to the Various manufacturing processes & Testing methods of Composites.
4. Understand the design principle

Outcome

The students should be able to understand,

1. Fibre characteristics and methods of production of fibres.
2. The suitablcomposite manufacturing process when designing intricate and critical parts made of composites
3. The testing methods of composites thoroughly and practical input obtained
4. The failure of composites well and the production of quality composites with design life ensured.

AIM

1. To study about various types of materials, manufacturing methods, tolerances in the design, manufacture and case studies for optimization in manufacturing.

UNIT I INTRODUCTION **10**

Factors for design based on mechanical, electrical and thermal properties - Dimensional tolerances, Factors considered for selection of materials.

UNIT II TYPES OF MATERIALS **10**

Ferrous metals and alloys - Steel, Stainless steel, Non-ferrous metals and alloys - Aluminium, Brass, Gun Metal.

UNIT III MANUFACTURING METHODS **16**

Design consideration in methods of manufacturing such as Casting - Sand casting , die casting, investment casting; Machining - Turning, drilling, milling and grinding; Unconventional - EDM, ECM; Forming techniques - Forging, extrusion, sheet metal forming; Powder metallurgy.

UNIT IV ASSEMBLY OF COMPONENTS **12**

Press fitting- riveting - screw fastening - flangedconnections of tubular parts - Joining of parts by welding, brazing and soldering.

UNIT V CASE STUDIES **12**

Case studies on optimization of design for cost, material and methods - Economics of machining.

Total : 60

REFERENCES

1. Crane.F.A.A. and Charles.J.A., "Selecton and use of Engineering Materials", Butterworths and Co., London,3rd Edition, 1997.
2. Gladius Lewis., "Selection of Engineering Materials", PHI, New Jersey, 2002.
3. Scrope Kalpakgain and Steven Schmid., "Manufacturing processes for engineering materials", IV Edition, Pearson Education Pvt.Ltd, 2003.
4. Dieter G.E., "Mechanical metallurgy", McGraw Hill, 2002.
5. James Brown, "Advanced Machining Technology Hand book", McGraw-Hill, 1998
6. Kenneth G.Budingski, "Surface Engineering for wear Resistance", Prentice Hall, 1988.

PCD 251- ANALYSIS AND SIMULATION LAB

L	T	P	C
0	0	3	1

Goal

To learn various finite element analysis softwares such as ANSYS, ADAMS, NASTRAN, etc.,

Objectives

The course should enable the students to:

1. Enhance interest in learning the design and analysis of components using software's such as Pro-E, Ansys V12,.
2. Understand the various concepts of analysis of mechanical systems.
3. Understand the concepts of finite element analysis involving mechanical, structural and thermal related problems.

Outcome

The students should be able to:

1. Develop the concepts and design the machine elements.

2. Analyze any mechanical components and visualize the results.

3. Take up any FEA related work and can solve it efficiently.

List of Excersices

Analysis of Mechanical Components - Use of FEA packages, like ANSYS, NASTRAN etc. Exercises shall include FEA analysis of

i) Machine elements under static loads

ii) Heat transfer in mechanical systems

iii) Determination of natural frequency

iv) Axi-Symmetric

v) Non-linear systems

Use of kinematics and dynamics simulation software like ADAMS software. Analysis of velocity acceleration for mechanical linkages of different mechanisms.

Equipments Required:

CAD work station / Pentium 4	:	10 Nos
ADAMS Software	:	2 Licenses
ANSYS / NASTRAN / ABACUS	:	10 Licenses

TOTAL 45

PCD 252 - DESIGN PROJECT

L	T	P	C
0	0	6	2

Goal

- To design and fabricate components related to Mechanical Engineering and demonstrate its working.

Objectives

The course should enable the students to:

1. Provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

2. Expose the students to technical report writing

Outcome

The students should be able to:

1. Understand the concept of making a complete product is achieved

2. Gain knowledge on preparing a technical report

The students should do the project individually and in exceptional cases 2 members may be permitted

to take one small item for design and simulation. Every project work shall have a guide who is the member of the faculty of the institution.

The students are required to design and simulate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain the required drawings, information flow diagrams, process charts related to simulation.

TOTAL 90

PCD 352 - PROJECT WORK PHASE - I

L	T	P	C
0	0	12	6

Goal

To identify a project in the thrust areas and to create a work plan to design, fabricate and to analyze the refrigeration and air conditioning systems.

Objectives

The course should enable the students to:

1. Provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.
2. To expose the students to do Literature survey and scheduling work plan.
3. Expose the students to technical report writing

Outcome

The students should be able to:

1. Students can identify the thrust areas in their field of interest.
2. Compare and analyze the performance of the various systems through literature survey.
3. Understand the concept of making a product is achieved
1. Gain knowledge on preparing a technical report.

Aim is to train the students in research work, writing report and presentation

Phase - I : Shall consist of identificationof the project after literature survey. Students should present a review paper & submit it to the internal examiners.

Report should summarise the methodology to be adopted and work plan for the project work Phase - II.

TOTAL : 180

PCD 451- PROJECT WORK PHASE - II

L	T	P	C
0	0	24	12

Goal

Identify a project in the thrust areas and to create a work plan to design,To design, fabricate and analyze any system related to mechanical engineering.

Objectives

The course should enable the students to:

1. Provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.
2. To expose the students to work as scheduled in work plan.
3. Expose the students to technical report writing

Outcome

The students should be able to:

1. Students can identify the thrust areas in their field of interest.
2. Compare and analyze the performance of the various systems both theoretically and practically through actual design and fabrication.
3. Complete understanding of making a product is achieved.
4. Students can prepare technical reports.

Requirement: Actual project work with presentation & submission of project report of thesis form to the examiners. The students should publish at least one paper in National / International conference or Journal before submission of the thesis. Proof of acceptance must be enclosed in the thesis.

TOTAL 360

PCD 701 - MODEL ANALYSIS OF MECHANICAL SYSTEMS

L	T	P	C
4	0	0	4

Goal

To make students to gain the concepts on model testing, measurement system, model analysis, review test procedure and to derive mathematical models.

Objectives

The course should enable the students to:

1. Introduce model testing and review of test procedure
2. Understand the concepts of analysis of non-linear structures
3. Gain the knowledge on mobility measurement techniques

4. Understand various methods of modal parameter extraction

5. Get exposed to the techniques on derivation of mathematical models

Outcome

The students should be able to:

1. Develop skills on model testing, measurement methods, summary of analysis and to review test procedure

2. Widen knowledge on SDOF/MDOF / FRF data and properties and to analyse non linear structures.

3. Good understand the concepts of measurement system,DSP,calibration, measurement on non linear structures

4. Gain the knowledge on model analysis,circle fit method, inverse method and curve fitting

5. Get exposure to different types of modal models, response model, spatial models and system models.

UNIT I OVERVIEW **9**

Introduction to Modal Testing - Applications of Modal Testing - Philosophy of Modal Testing - Summary of Theory - Summary of Measurement Methods - Summary of Analysis - Review of Test Procedure.

UNIT II THEORETICAL BASIS **15**

Introduction - Single Degree of Freedom (SDOF) System Theory - Presentation and Properties of FRF Data for SDOP System - Undamped Multi-degree of freedom (MDOF) system - Proportional Damping - Hysteretic Damping - General Case - Viscous Damping - General Case - Characteristics and presentation of MDOF - FRF Data - Complete and incomplete models - Non-sinusoidal vibration and FRF Properties - Analysis of Weakly Nonlinear Structures.

UNIT III MOBILITY MEASUREMENT TECHNIQUES **13**

Introduction - Basic Measurement System - Structure preparation - Excitation of the Structure - Transducers and Amplifiers- Analyzers - Digital Signal Processing - Use of Different Excitation types - Calibration - Mass Cancellation - Rotational Mobility Measurement - Measurement on Non linear structures - Multi point excitation methods.

UNIT IV MODAL PARAMETER EXTRACTION METHODS **14**

Introduction - Preliminary checks of FLRF Data - SDOF Modal Analysis-I - Peak-amplitude - SDOF Modal Analysis-II - Circle Fit Method - SDOF Modal Analysis III - Inverse Method - Residuals - MDOF curve-fitting procedures - MDOF curve fitting the Time Domain - Global or Multi-Curve fitting - Non linear systems.

UNIT V DERIVATION OF MATHEMATICAL MODELS **9**

Introduction - Modal Models - Display of Modal Model - Response Models - Spatial Models - Mobility Skeletons and System Models.

Total : 60

REFERENCES:

1. Ewins D J, "Modal Testing: Theory and Practice ", John Wiley & Sons Inc., 2nd Edition 2000.
2. Nuno Manuel Mendes Maia et al," Theoretical and Experimental Modal Analysis", John Wiley & Sons, 1997.

WEB REFERENCES:

1. www.vibetech.com/tech.paper.htm
2. http://scholar.lib.vt.edu/ejournals/MODAL/abstracts/ijaema-1987.html

PCD 702 - RAPID PROTOTYPING & TOOLING

L	T	P	C
4	0	0	4

Goal

To expose the concepts of computer aided design processes with practical exposure to develop physical models using rapid prototyping machines for the CAD models.

Objectives

The course should enable the students to:

1. Provide an overview of the design process using CAD software.
2. To understand and develop RP models to realizable the physical and functional details of the designed product.
3. Learn the techniques used Rapid prototype machines.

Outcome

The students should be able to:

1. Understand the engineering design process using computer aided design.
2. Understand the principle of prototyping and various prototyping techniques.
3. Understand the concepts of integration of CAD software with RP machine to obtain RP model and manufacturing.

UNIT - I **10**

Introduction : Need for time compression in product development, Product development - conceptual design - development - detail design - prototype - tooling.

UNIT - II **12**

Classificationof RP systems, Stereo lithography systems - Principle - process parameters - process details - machine details, Applications.

Direct Metal Laser Sintering (DMLS) system - Principle - process parameters - process details - machine details, Applications.

UNIT -III **12**

Fusion Deposition Modeling - Principle - process parameters - process details - machine details, Applications.

Laminated Object Manufacturing - Principle - process parameters - process details - machine details, Applications.

UNIT - IV **13**

Solid Ground Curing - Principle - process parameters - process details - machine details, Applications, 3-Dimensional printers - Principle - process parameters - process details - machine details, Applications, and other concept modelers like thermo jet printers, Sander's model maker, JP system 5, Object Quadra system.

UNIT - V **13**

Laser Engineering Net Shaping (LENS), Ballistic Particle Manufacturing (BPM) - Principle, Introduction to rapid tooling - direct and indirect method, software for RP - STL files, Magics, Mimics. Application of Rapid prototyping in Medical field.

Total : 60

REFERENCES:

1. Terry wohlers, Wohlers Report 2000, Wohlers Associates, USA, 2000.
2. Rapid Prototyping and manufacturing - Fundamentals of Streolithography, Paul F Jacobs, Society of Manufacturing Engineering Dearborn, USA 1992.
3. Rapid Prototyping and Tooling, Industrial Design Centre, IIT, Mumbai, 1998.
4. Pham,D.T. & Dimov.S.S., Rapid manufacturing, Springer-Verlag, London, 2001.

PCD 703 - TRIBOLOGY IN DESIGN

L	T	P	C
4	0	0	4

Goal

To expose the students on the study and application of the principles of friction, lubrication and wear.

Objectives

The course should enable the students to:

1. Learn the principles of friction and wear.
2. Understand the standard procedure available for tribology using standard data and catalogues
3. Design the fluid film bearings, rolling element bearings etc.,

Outcome

The students should be able to:

1. Design bearings of various types.
2. Perform the various measurements on surfaces and bearings.

UNIT I SURFACES, FRICTION AND WEAR 11

Topography of Surfaces - Surface features - Surface interaction - Theory of Friction - Sliding and Rolling Friction, Friction properties of metallic and non-metallic materials - Friction in extreme conditions - Wear, Types of wear - Mechanism of wear - Wear resistance materials - Surface treatment - Surface modifications - Surface coatings.

UNIT II LUBRICATION THEORY 11

Lubricants and their physical properties, Lubricants standards - Lubrication Regimes Hydrodynamic lubrication - Reynolds Equation, Thermal, Inertia and Turbulent effects - Elasto hydrodynamic and plasto hydrodynamic and magneto hydrodynamic lubrication - Hydro static lubrication - Gas lubrication.

UNIT III DESIGN OF FLUID FILM BEARINGS 15

Design and performance analysis of thrust and journal bearings - Full, partial, fixed and pivoted journal bearings design - Lubricant flowand delivery - Power loss, Heat and temperature rotating loads and dynamic loads in journal bearings - Special bearings - Hydrostatic Bearing design.

UNIT IV ROLLING ELEMENT BEARINGS 13

Geometry and kinematics - Materials and manufacturing processes - Contact stresses - Hertzian stress equation - Load divisions - Stresses and deflection- Axial loads and rotational effects, Bearing life capacity and variable loads - ISO standards - Oil films and their effects - Rolling Bearings Failures.

UNIT V TRIBO MEASUREMENT IN INSTRUMENTATION 10

Surface Topography measurements - Electron microscope and friction and wear measurements- Laser method - instrumentation - International standards - Bearings performance measurements - Bearing vibration measurement.

Total : 60

REFERENCES:

1. Cameron, A. "Basic Lubrication Theory", Ellis Herward Ltd., OK, 3rd edition, 1981
2. Hulling, J. (Editor) - "Principles of Tribology ", Macmillian - 1984.
3. Williams J.A. " Engineering Tribology", Oxford Univ. Press, 1994.
4. Neale, M.J. "Tribology Hand Book", Butterworth Heinemann, 1995.

PCD 704 - DESIGN OF FLUID POWER SYSTEMS

L	T	P	C
4	0	0	4

Goal

To impart the knowledge on hydraulic and pneumatic systems to make the students to be able to design various components of fluid power systems.

Objectives

The course should enable the students to be familiar with:

1. Hydraulic actuators and Pneumatic actuators and systems
2. Control and regulation elements
3. Hydraulic circuits
4. Pneumatic systems and circuits
5. Installation, Maintenance of systems
6. Special circuits.

Outcome

The students should be able to:

1. Demonstrate good grounding in the subject area of fluid power
2. Appreciate the circuits and feel the advantages over the similar mechanical systems
3. Gain knowledge no the use of special control and regulation elements

UNIT I OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS 8

Hydraulic Power Generators - Selection and specificationof pumps, Pump characteristics. Linear and Rotary Actuators - Selection, specification and characteristics.

UNIT II CONTROL AND REGULATION ELEMENTS 15

Pressure - direction and flowcontrol valves - relief valves, non-return and safety valves - actuation systems.

UNIT III HYDRAULIC CIRCUITS 8

Reciprocation, quick return, sequencing, synchronizing 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 19

Pneumatic fundamentals - control elements, position and pressure sensing - Logic circuits - switching circuits - fringe conditions modules and these integration - Sequential circuits - cascade methods - step counter method - Compound circuit design - Combination circuit design.

UNIT V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 10

Pneumatic equipments- selection of components - design calculations - application -fault finding- hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

Total : 60

REFERENCES:

1. Antony Espossito, "Fluid Power with Applications", Prentice Hall, 1980.
2. Dudleyt, A. Pease and John J. Pippenger, "Basic fluid power", Prentice Hall, 1987.
3. Andrew Parr, "Hydraulic and Pneumatics" (HB), Jaico Publishing House, 1999.
4. Bolton. W., "Pneumatic and Hydraulic Systems ", Butterworth -Heinemann, 1997.

WEB REFERENCES:

1. www.pneumatics .com
2. www.fluidpower.com.tw

PCD 705 - INTEGRATED PRODUCT & PROCESSES DEVELOPMENT

L	T	P	C
4	0	0	4

Goal

To provide the advances of formal and informal communication in product development, modeling innovation processes and design of products.

Objectives

The course should enable the students to:

1. Understand the concept of integrated product and process development that combined the product design process to create a new standard for providing competitive and high quality products.
2. Gain the knowledge on the product design and development process.

Outcome

The students should be able to:

1. Gain knowledge on the various process of design and processes involved in product development.

UNIT I INTRODUCTION 12

Characteristics of Successful Product Development-Who Designs and Develops Products-Duration and Costs of Product Development- Challenges of Product Development -Development Processes and Organizations-A Generic Development Process-Concept Development: The Front-End Process

Adapting the Genetic Product Development Process- Product Development Process Flows-The AMF Development Process-Product Development Organizations-The AMF Organization

UNIT II PRODUCT PLANNING **12**

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

UNIT III PRODUCT SPECIFICATIONS **12**

What are specifications-When are specificationsestablished-Establishing target Specifications-Setting the Final Specifications-ConceptGeneration-The Activity of Concept Generation-Clarify the Problem-Search Externally-Search Internally-Explore Systematically- Reflecton the Results and the Process.

UNIT IV CONCEPT SELECTION **12**

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

UNIT V PRODUCT ARCHITECTURE **12**

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

Total: 60

REFERENCES:

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

PCD 706 - COMPOSITE MATERIALS & MECHANICS

L	T	P	C
4	0	0	4

Goal

- To impart in depth knowledge of the various composite materials and their components like fibres, matrix materials and their behaviour in the manufacturing and testing processes.
- To predict the failures of composites when subjected to various forms of stresses using NDT methods and quality evaluation.

Objectives

The course should enable the students to:

1. Study the types of fibres and their structure and behaviors
2. Study the mathematical analysis of stresses acting on the composites
3. Expose to the Various manufacturing processes & Testing methods of Composites.
4. Understand the design principle.

Outcome

The students should be able to understand,

1. Fibre characteristics and methods of production of fibres
2. The suitable composite manufacturing process when designing intricate and critical parts made of composites
3. The testing methods of composites thoroughly and practical input obtained
4. The failure of composites well and the production of quality composites with design life ensured.

UNIT I INTRODUCTION **12**

Definition- Need - General Characteristics, Applications. Fibers - Glass, Carbon, Ceramic and Aramid fibers.Matrices - Polymer, Graphite, Ceramic and Metal Matrices - Characteristics of fibers and matrices. Smart materials Types- and Characteristics.

UNIT II MECHANICS AND PERFORMANCE **12**

Characteristics of Fiber-Lamina - Laminates - Interlaminar stresses - Static Mechanical Properties - Fatigue and Impact Properties - Environmental effects - Fracture Behavior and Damage Tolerance.

UNIT III MANUFACTURING **12**

Bag Moulding - Compression Moulding - Pultrusion - Filament Winding - Other Manufacturing Processes - Quality Inspection methods.

UNIT IV ANALYSIS **12**

Stress Analysis of Laminated Composites Beams, Plates, Shells - Vibration and Stability Analysis - Reliability of Composites - Finite Element Method of Analysis - Analysis of Sandwich structures.

UNIT V DESIGN **12**

Failure Predictions - Laminate Design Consideration - Bolted and Bonded Joints Design Examples.

Total : 60

REFERENCES:

1. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
2. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
3. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.
4. Mallick, P.K., Fiber - "Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.

PCD 707 - Composite Materials & Mechanics

L	T	P	C
4	0	0	4

Goal

To impart the knowledge on various dynamic systems and control of such system.

Objectives

The course should enable the students to:

1. Understand the various dynamics systems
2. Study the performance and stability of various feedback systems
3. Analyse the signal flows and the control system

Outcome

The students should be able to understand,

1. Gain the knowledge on the dynamic systems and the block diagram representations
2. Exposure to the performance and stability of feedback systems.
3. Gain the understanding of various methods of control system analysis.

UNIT I INTRODUCTION **12**

Introduction - Dynamic system classification, Analysis and Design of Dynamic system, Mathematical modeling of Dynamic systems - Mechanical systems - Electrical systems, Electromechanical Systems - Fluid & Thermal system, Review of vibration of single degree, Two degree freedom systems, Review of matrix algebra and Laplace Transforms.

UNIT II INTRODUCTION TO CONTROL SYSTEMS **12**

Introduction - Control systems - Control system configurations- Control system Terminology - Control system classes - Feedback systems - Analysis of Feedback - Historical Developments of control systems - Control system analysis and Design Objectives.

UNIT III SYSTEM REPRESENTATION **12**

Introduction - Block Diagrams - Block Diagrams Representation - Block Diagram Reduction - Signal flowgraphs - Signal flowgraph algebra - Mason's Gain formula - Zeros and Additional poles.

UNIT IV PERFORMANCE AND STABILITY OF FEEDBACK SYSTEMS **12**

Introduction - Properties of feedback - Transient response specifications- Controller types and actions - Stability of control systems - Routh-Hurwitz criterion - Steady state error - Control system types.

UNIT V ANALYSIS OF CONTROL SYSTEMS **12**

Introduction - analysis of control systems - Root-Locus analysis - Bode analysis - Nyquist analysis - Nyquist stability criterion - Nichols chart analysis - Frequency Domain specifications.

Total : 60

REFERENCES

1. Benjamin C.Kuo, 'Automatic Control systems', Prentice-Hall of India Pvt. Ltd., New Delhi. 7th Edition 2009.
2. Thomson W.T., 'Theory of Vibration with Applications', CBS Publishers and Distributors, New Delhi, 3rd Edition 2002.
3. Rao.V.Dukkipati, 'Engineering system Dynamics', Narosa Publishing House, New Delhi , 2007.

PCD 708 - ADVANCED TOOL DESIGN

L	T	P	C
4	0	0	4

Goal

To Build up specialized expert knowledge in the domain of material, for different kinds of tools used in manufacturing industries and also to familiarize in the knowledge of designing and manufacturing the cutting tools, dies, jigs and future for conventional and CNC machine tools.

Objectives

The course should enable the students to:

1. Understand the importance of tool design for productive manufacturing and the basic procedure of tool design, drafting of tool drawing etc.,
2. Bring in the required properties in the tool material by proper selection and heat treatment appropriate to the cutting process adopted.
3. Understand the concepts of tolerance and make use of gauges to measure the same

4. Understand the design concepts of Jigs & Fixtures

5. Get proper knowledge in the latest area of tooling for CNC machines tools.

Outcome

The students come out with the following:

1. The conventional practice and procedures adopted for tools & Design such as problem statement, Drafting Hole location, Bush installation etc is understood

2. The knowledge on materials for cutting tools, heat treatment required for different materials and different types of tools is obtained

3. The design of dies, gauges and the importance of tolerance in the manufacturing and inspection of dies & gauges is understood

4. Jig & Fixtures design for all type of machine tool is done appropriately.

5. Tooling for CNC machine tools and automatic machine are also made effectively

UNIT I TOOL-DESIGN METHODS 8

Introduction - The Design Procedure - Statement of the problem - The Needs Analysis - Research and Ideation - Tentative Design Solutions - The Finished Design - Drafting and Design Techniques in Tooling drawings - Screws and Dowels - Hole location - Jig-boring practice - Installation of Drill Bushings - Punch and Die Manufacture - Electro-discharge machining - Electro-discharge machining for cavity.

UNIT II TOOLING MATERIALS AND HEAT TREATMENT 12

Introduction - Properties of Materials - Ferrous Tooling Materials - Tool steels - Cast Iron - Mild, or low-carbon Steel - Non-metallic Tooling Materials - Non-ferrous Tooling 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.

UNIT III DESIGN OF DRILL JIGS 12

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

UNIT IV DESIGN OF FIXTURES AND DIES 17

Introduction - Fixtures and economics - Types of Fixtures - Vise Fixtures - Milling Fixtures - Boring Fixtures - Broaching Fixtures - Lathe Fixtures - Grinding Fixtures - Types of Die construction - 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 V TOOL DESIGN FOR NUMERICALLY CONTROLLEDMACHINE TOOLS 11

Introduction - The need for numerical control - A basic explanation of numeric control - Numerical control systems in use today - Fixture design for numerically controlled machine tools - Cutting tools for numerical control - Tool holding methods for numerical control - Automatic tool changers and tool positioners - Tool presetting - Introduction - General explanation of the Brown and sharp machine - tooling for Automatic screw machines.

Total : 60

REFERENCES:

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, "Tool Design", Tata McGraw Hill Publishing Company Ltd., 3rd Edition 2010..
2. Prakash Hiralal Joshi, "Tooling data", Wheeler Publishing, 2000
3. Edward G.Hoffman, Jigs & Fixture Design, Thomson-Delmar Learning, Singapore, 5th Edition,2005
4. Donaldson.C,Tool Design, Tata McGraw-Hills,3rd Edition,2010
5. Kempster, Jigs & Fixture Design, The English Language Book Society, 2004.
6. Joshi, P.H.,Jigs & Fixtures, Second Edition, Tata McGraw-Hill Publishing Company Limited,New Delhi 2004.
7. Hiram E Grant, Jigs & Fixture Tata McGraw-Hill, New Delhi,2009
8. Fundamentals of Tool Design, CEEE Edition, ASTME, 1983
9. Design Data Handbook PSG College of Technology, Coimbatore, 2010.

Web references:

1. www.irdi.on.ca/irdi/front.htm
2. www.techsolve.org/flashhome.htm

PCD 709 - DESIGN FOR MANUFACTURE, ASSEMBLY & ENVIRONMENTS

L	T	P	C
4	0	0	4

Goal

To learn the design concepts of a product/component considering the manufacturability, ease of assembly and environmental safety into account.

Objectives

The course should enable the students to:

1. Introduce design principles, properties of materials, fits and tolerances and datum features.
2. Understand the influence of materials on form design and able to select possible material and feasible design.

3. Introduce design features to facilitate machining and design for mach inability, economy, accessibility and assembly.

4. Know about redesign of castings, modifying the uneconomical design, group technology and applications of DFMA.

5. Understand the Environmental objectives and issues and to design considering them.

Outcome

The students should be able to:

1. Select the design principle, suitable material, mechanism, fit and tolerance for designing a product/component.

2. Select the appropriate material, proper working principle and a feasible design.

3. Design (optimum) a component which requires less material removal, easy to machine, assemble, access and cost effective.

4. Redesign the uneconomical casting design and know the applications of DFMA.

5. Incorporate the Environmental Objectives, issues and guidelines into the design.

UNIT I INTRODUCTION 8

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

UNIT II FACTORS INFLUENCING FORM DESIGN 16

Working principle, Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

UNIT III COMPONENT DESIGN - MACHINING CONSIDERATION 11

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

UNIT IV DESIGN - CASTING CONSIDERATION 13

Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores.

Identificationof uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

UNIT V DESIGN FOR THE ENVIRONMENT 12

Introduction - Environmental objectives - Global issues - Regional and local issues - Basic DFE methods - Design guide lines Design to minimize material usage - Design for disassembly- Design

for recyclability - Design for remanufacture - Design for energy efficiency- Design to regulations and standards.

Total : 60

REFERENCES:

1. Boothroyd, G, 1980 Design for Assembly Automation and Product Design. Marcel Dekker,NY.
2. Bralla, Design for Manufacture handbook, McGraw hill, 1999.
3. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.
4. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.
5. Fixel, J, Design for the Environment, McGraw hill., 1996.
6. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub., 1996.
7. Kevien Otto and Kristin Wood, Product Design, Pearson Publication, 2006.

WEBSITE

1. www.ulrich - Epingar. Net
2 www.dfma.com

PCD 710 - PLASTICITY & METAL FORMING

L	T	P	C
4	0	0	4

Goal

To impart in-depth knowledge on the metal forming process through fundamental concepts of plastic deformation, analysis of forgoing, rolling, drawing and other forming process, and the development of advanced Processes for latest and new materials Management", Kluwer Academic Press, 1996.

Objectives

The course should enable the students to:

1. Study the basic concepts of yield, stress, strain relationship in depths for plastic deformation of metal
2. Mathematically analysis various forming process and to understand the experiment technique for evaluating the same
3. Understand the unique Mechanical properties that are more relevant for plastic instability
4. Study the theory of sheet metal forming through anisotropic behaviors
5. Know the concepts of Advanced metal forming techniques and power metal techniques including analysis through FEM

Outcome

The students should be able to:

1. Gain knowledge on engineering stress, strain relationship yield criteria, equilibrium conditions
2. Gain knowledge on analytical and experimental techniques of various forming methods
3. Gain the sheet metal forming in understood by forming limit Diagram finite dement methods etc.,

UNIT I THEORY OF PLASTICITY 12

Theory of plastic deformation - Engineering stress and strain relationship - Stress tensor - Strain tensor - Yield criteria's - Plastic stress strain relationship - Plastic work - Equilibrium conditions - Incremental plastic strain.

UNIT II CONSTITUTIVE RELATIONSHIPS AND INSTABILITY 10

Uniaxial tension test - Mechanical properties - Work hardening, Compression test, bulge test, plane strain compression stress, plastic instability in uniaxial tension stress, plastic instability in biaxial tension stress.

UNIT III ANALYSIS OF METAL FORMING PROBLEMS 15

Slab analysis - Slip line method, upper bound solutions, statistically admissible stress field, numerical methods, contact problems, effect of friction, thermo elastic Elasto plasticity, elasto visco plasticity - Thermo mechanical coupling - Analysis of forging, rolling, extrusion and wire drawing processes - Experimental techniques of the evaluation of metal forming.

UNIT IV SHEET METAL FORMING 11

Bending theory - Cold rolling theory - Hill's anisotropic theory, Hill's general yield ttheory - Sheet metal forming - Elements used - Mesh generation and formulation - Equilibrium equations - Consistent full set algorithm - Numerical solutions procedures - examples of simulation of simple parts - Bench mark tests - Forming limit diagrams.

UNIT V ADVANCES IN METAL FORMING 12

Orbital forging, Isothermal forging, Warm forging, Hot and Cold Isotropic pressing, Highspeed extrusion, rubber pad forming, Miscro blanking- Overview of Powder Metal Technique- Powder rolling-Tooling and process parameters.

TOTAL 60

PCD 711 - VIBRATION CONTROL & CONDITION MONITORING

L	T	P	C
4	0	0	4

Goal

To provide the knowledge on various vibration control techniques and condition monitoring systems.

Objectives

The course should enable the students to

1. Gain knowledge on fundamentals of various degrees of freedom.
2. Understand the concept of active vibration control.
3. Learn condition based maintenance principles and applications.
4. Gain knowledge on dynamic balancing and alignment of machinery.
5. Gain knowledge on vibration control.

Outcomes

The students gain the knowledge on

1. Fundamentals of various degrees of freedom.
2. Active vibration control.
3. Condition based maintenance principles and applications.
4. dynamic balancing and alignment of machinery.
5. Vibration control.

UNIT I INTRODUCTION **15**

Review of Fundamentals of Single Degree Freedom Systems - Two Degree Freedom Systems, Multi Degree Freedom System, Continuous system, Determination of Natural frequencies and mode shapes, Numerical methods in Vibration Analysis.

UNIT II VIBRATION CONTROL **15**

Introduction - Reduction of Vibration at the Source - Control of Vibration - by Structural design - Material Selection - Localized additions - Artificialdamping - Resilient isolation, Vibration isolation, Vibration absorbers.

UNIT III ACTIVE VIBRATION CONTROL **9**

Introduction - Concepts and applications, Review of smart materials - Types and Characteristics, Review of smart structures - Characteristics Active vibration control in smart structures.

UNIT IV CONDITION BASED MAINTENANCE PRINCIPLES AND APPLICATIONS **13**

Introduction - Condition Monitoring Methods - The Design of Information system, selecting methods of monitoring, Machine condition monitoring and diagnosis - Vibration severity criteria - Machine

maintenance techniques - Machine condition monitoring techniques - Vibration monitoring techniques - Instrumentation systems - Choice of monitoring parameter.

UNIT V DYNAMIC BALANCING AND ALIGNMENT OF MACHINERY 9

Introduction, Dynamic Balancing of Rotors, Field Balancing in one Plane, two Planes, and in several Planes, Machinery Alignment, "Rough" Alignment Methods, The Face- Peripheral Dial Indicator Method, Reverse Indicator Method, Shaft-to-coupling spool method.

Total : 60

REFERENCES:

1. K.J. Bathe and F.I., Wilson - "Numerical Methods in Finite Element Analysis" - Prentice Hall of India Pvt. Ltd., New Delhi, 1978.
2. J.O. Den Hartog - "Mechanical Vibrations" - McGraw Hill, Newyork, 1985.
3. Rao, J.S." Vibratory Condition Monitoring of Machines ". CRC Press, 2000.
4. Science Elsevier," Hand Book of Condition Monitoring", Elsevier Science, 1996.
5. Singiresu S. Rao, "Mechanical Vibrations", Addison-Wesley Publishing Company, 1995.

WEB REFERENCES:

1. http://www.ecgcorp.com/velav/
2. http://www.auburn.edu/isvd/
3. www.vibetech.com/techpaper.htm

PCD 712 - INDUSTRIAL ROBOTICS & EXPERT SYSTEMS

L	T	P	C
4	0	0	4

Goal

To introduce the hardware and programming concepts of industrial robots and their applications.

Objectives

The course should enable the students to

1. Learn the concepts of robot kinematics.
2. Learn the principles of robot drives and controls.
3. Learn the sensors used in robots.
4. Learn the robot cell design.
5. Learn the concepts of expert systems.

Outcome

The students should be able to

1. Gain the knowledge on kinematics of robots and adaptive control.
2. Gain the knowledge on the robot actuators and controls.
3. Gain the knowledge on sensors and selection of sensors for specific need.
4. Gain the knowledge on robot cell layouts and their applications.
5. Gain the knowledge on robot programming and artificial intelligence in robots.

UNIT I INTRODUCTION AND ROBOT KINEMATICS 13

Definition ,need and scope of Industrial robots - Robot anatomy - Work volume - Precision movement - End effectors - Sensors.

Robot Kinematics - Forward & reverse transformation of type form depres of - Control of robotneedem manipulators - Adaptive control, Model, Reserenced adaptive control.

UNIT II ROBOT DRIVES AND CONTROL 12

Controlling the Robot motion - Position and velocity sensing devices - Design of drive systems - Hydraulic and Pneumatic drives - Linear and rotary actuators and control valves - Electro hydraulic servo valves, electric drives - Motors - Designing of end effectors - Vacuum, magnetic and air operated grippers.

UNIT III ROBOT SENSORS 12

Transducers and Sensors - Sensors in Robot - Tactile sensor - Proximity and range sensors - Sensing joint forces - Robotic vision system - Image Gribbing - Image processing and analysis - Image segmentation - Pattern recognition - Training of vision system.

UNIT IV ROBOT CELL DESIGN AND APPLICATION 12

Robot work cell design and control - Safety in Robotics - Robot cell layouts - Multiple Robots - Robot cycle time analysis. Industrial application of robots.

UNIT V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPORT SYSTEMS 11

Methods of Robot Programming - Characteristics of task level languages lead through programming methods - Motion interpolation. Artificialintelligence - Basics - Goals of artificial intelligence - AI techniques - problem representation in AI - Problem reduction and solution techniques - Application of AI in Robots.

Total : 60

REFERENCES:

1. Yoram Koren," Robotics for Engineers' McGraw-Hill, 1987.
2. Kozyrey, Yu. "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering - An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.

4. Deb, S.R." Robotics Technology and Flexible Automation", Tata McGraw-Hill, 1994.

5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", McGraw-Hill, Int. 1986.

6. Timothy Jordanides et al ,"Expert Systems and Robotics ", Springer -Verlag, New York, May 1991.

6. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill, 2008.

PCD 713 - ENTERPRISE RESOURCE PLANNING

L	T	P	C
4	0	0	4

Goal

To provide the students with knowledge on various enterprise resource planning techniques.

Objectives

The course should enable the students to

1. Gain knowledge on enterprise resource planning.
2. Understand technology and architecture.
3. Learn system packages.
4. Gain the knowledge on oracle and its applications.
5. Gain the knowledge on unit erp procurement issues.

Outcomes

The students gain the knowledge on

1. Enterprise resource planning.
2. Technology and architecture.
3. System packages.
4. Oracle and it's applications.
5. unit erp procurement issues.

UNIT I ENTERPRISE RESOURCE PLANNING **13**

Principle - ERP framework - Business Blue Print - Business Engineering vs Business process Re-Engineering - Tools - Languages - Value chain - Supply and Demand chain - Extended supply chain management - Dynamic Models -Process Models

UNIT II TECHNOLOGY AND ARCHITECTURE **13**

Client/Server architecture - Technology choices - Internet direction - Evaluation framework - CRM - CRM pricing - chain safety - Evaluation framework.

UNIT III SYSTEM PACKAGES **13**

SAP - People soft, Baan and Oracle - Comparison - Integration of different ERP applications - ERP as sales force automation - Integration of ERP and Internet - ERP Implementation strategies - Organizational and social issues.

UNIT IV ORACLE **10**

Overview - Architecture - AIM - applications - Oracle SCM.

SAP:Overview -Architecture - applications -Before and after Y2k - critical issues - Training on various modules of IBCS ERP Package-Oracle ERP and MAXIMO, including ERP on the NET

UNIT V UNIT ERP PROCUREMENT ISSUES **11**

Market Trends - Outsourcing ERP - Economics - Hidden Cost Issues - ROI - Analysis of cases from five Indian Companies.

Total : 60

REFERENCES:

1. Sadagopan. S , ERP-A Managerial Perspective, Tata McGraw Hill, 1999.
2. Jose Antonio Fernandez, The SAP R/3 Handbook, Tata McGraw Hill, 1998.
3. Vinod Kumar Crag and N.K.Venkitakrishnan, Enterprise Resource Planning - Concepts and Practice, Prentice Hall of India, 1998.
4. ERPWARE, ERP Implementation Framework, Garg & Venkitakrishnan, Prentice Hall, 1999.
5. Thomas E Vollmann and Bery Whybark, Manufacturing and Control Systems, Galgothia Publications, 1998.

PTE 701 - COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
4	0	0	4

Goal

To impart the knowledge on numerical methods and algorithm to solve various various complex problems in fluid mechanics.

Objectives

The course should enable the students to:

1. Learn about different governing equation and boundary condition
2. Enable the students to understand the various discretisation techniques and solving solution methodologies.
3. Understanding the Navier-stroke equation for different flow field.
4. Understand the requirement of the different turbulence model for solving the Reynolds Average Navier-stroke equation
5. Learn the different grid generation methods

Outcome

The students should be able to gain the knowledge on:

1. Formation different governing equation like continuity, momentum and energy equation
2. Discretisation equation using finite difference method and finite volume methods, numerical error associated with first order and second order.
3. Derivation of Reynolds average Nevier-stroke equation
4. Closure problem associated with Reynolds average Nevier stroke equation using different turbulence model.
5. Generation of the grid required in the computational domain for solving the Navier-stroke equation.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

Basics of CFD, Governing equations of Fluid Dynamics - Continuity momentum and Energy equations, Physical Boundary conditions, Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II DISCRETISATION TECHNIQUES AND SOLUTION METHODOLOGIES 18

Methods of deriving discretisation equations - Finite difference & Finite volume methods, Finite difference discretisation of wave equation, Laplace equation, Burger's equation, numerical error and stability analysis. Time dependent methods - Explicit, Implicit - Crank - Nicolson methods, time split methods. Solution methodologies - Direct & iteractive methods - Thomas algorithm - Relaxation method - Alternate Direction Implicit method.

UNIT III CALCULATION OF FLOW - FIELD FOR N - S EQUATIONS 16

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional convection and diffusion. Representation of the pressure - Gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections - Pressure - Correction equation, SIMPLE algorithm and its variants.

UNIT IV TURBULENCE MODELLING 10

Time - averaged equation for turbulent flow,Turbulence Models - Zero equation model, one equation model, two equation k- models, Advanced models.

UNIT V GRID GENERATION 8

Algebraic Methods - Differential Equation methods - Adaptive grids.

Total : 60

REFERENCES

1. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 2nd Edition 2008..

2. Ghoshdasdidar, P.S., "Computer Simulation of flowand heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.

3. Subas, V.Patankar "Numerical heat transfer fluidflow",Hemisphere Publishing Corporation, 2009.

4. Taylor, C and Hughes, J.B. "Finite Element Programming of the Navier Stokes Equation", Pineridge Press Limited, U.K., 1981.

5. Fletcher, C.A.J. "ComputationalTechniques for Fluid Dynamics Vol 1" Fundamental and General Techniques, Springer - Verlag, 1987.

6. Fletcher, C.A.J. "Computational Techniques for Fluid Dynamics Vol 2" SpecificTechniques for Different Flow Categories, Springer - Verlag, 1987.

7. Bose, T., "Numerical Fluid Dynamics" Narosa Publishing House, 1997.

8. Versteeg, H.K, and Malalasekera, Wan Introduction to Computational Fluid Dynamics: The Finite Volume Method", Longman, 1998

9. D. A, Anderson, John C. Tannehill, Richard H. Pletcher - Computational Fluid Mechanics and Head Transfer, Hemisphere publishing corporation, McGraw - Hill book company, USA, 1984.

PCD 714 - COMPUTER APPLICATION DESIGN

L	T	P	C
4	0	0	4

Goal

To impart the knowledge on computer application in design and the solving techniques of various engineering problems.

Objectives

The course should enable the students to:

1. Learn the fundamental of computer graphic fundamentals, visual realism and solid modeling
2. Solve techniques of various engineering problems.

Outcome

The students should be able to:

1. Use the cad software and graphic fundamentals
2. Have a good grip on analysis of the models modelled in any of the modelling software.

UNIT I INTRODUCTION TO COMPUTER GRAPHIC FUNDAMENTALS 13

Output primitives (points, lines, curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotators) windowing - view ports - clipping transformation.

UNIT II INTRODUCTION TO CAD SOFTWARE 13

Writing interactive programs to solve design problems and production of drawings - using any languages

like Auto LISP/C/FORTRAN etc.- creation of surfaces - solids etc. using solid modeling packages (prismatic and revolved parts).

UNIT III VISUAL REALISM **13**

Hidden - Line - Surface - solid removal algorithms shading - coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages.

UNIT IV ASSEMBLY OF PARTS **11**

Assembly of parts, tolerances analysis mass property calculations, mechanism simulation.

UNIT V SOLID MODELING **11**

Rapid prototyping - Data exchange - documentation - customizing solid modeling system.

Total :60

REFERENCES:

1. William M Neumann and Robert F. Sproul "Principles of Computer Graphics", Mc Graw Hill Book Co. Singapore, 1989
2. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 2nd Edition , 2008.
3. Mikell, P. Groves and Emory W. Zimmers Jr. "CAD/Cam Computer -Aided Design and Manufacuring" Prentice Hall Inc., 1995.
4. Ibrahim Zeid Mastering CAD/CAM - "Theory and Practice" - McGraw Hill, International Edition, 1998.

PCD 715 - COMPUTER INTEGRATED MANUFACTURING

L	T	P	C
3	0	1	4

Goal

To impart knowledge on integrated of computers at various levels of planning and manufacturing.

Objectives

The course should enable the students to:

1. Introduce the flexible manufacturing system and
2. Handle the product data and various software used for manufacturing
3. Understand Computer Aided Process Planning.

Outcome

The students should be able to:

1. Appreciate the changing manufacturing scene
2. Develop the role of CAD/CAM
3. Understand implementation of CIM.

UNIT I MANUFACTURING TECHNOLOGY **12**

Overview-current themes in manufacturing -design- manufacture interface-overview of process planning technique.

UNIT II PRODUCTION PLANNING AND CONTROL **12**

Discrete parts manufacturing-topology in manufacturing classificationof FMS decision Lean production-BPRMaster production scheduling-Requirements Planning-JIT.

UNIT III GROUP TECHNOLOGY AND PROCESS PLANNING **12**

Part families, classification and coding-type of codification-case study-computer aided process planning-retrieval and generative.

UNIT IV FLEXIBLE MANUFACTURING SYSTEMS **12**

Need classification-Integration-Interface-Software for FMS-Production flow analysis - flexible material handling -Petri network-applications.

UNIT V MANUFACTURING SIMULATION **12**

Simulation language - type of software package-Simulation process-FIST codes-Case study.

UNIT VI PRACTICALS **12**

Total No of periods: 60

REFERENCES:

1. "CAD CAM " - Chris McMohan & Jimmi Brown ,Addison,Wiley-2000.
2. "Manufacturing High Tech Handbook " - Donatas tijunela & Kirth E. Mckee-2000.
3. "Performance Modelling and Analysis of Automated Manufacturing systems " - Narahari and Viswanadham-Prentice Hall-2005.

PCD 716 NON DESTRUCTIVE TESTING METHODS

L	T	P	C
4	0	0	4

Goal

To impart knowledge on Non Destructive Testing (NDT) Procedures.

Objectives

The course should enable the students to

1. To understand the principles behind various NDT techniques
2. To study about NDT equipments and accessories
3. To learn working procedures of various NDT techniques

Outcome

The students should be able to

1. Demonstrate good grounding in the area of NDT
2. To select proper NDT Method for his application
3. Understand the utilization of test and measurement appropriate to the area of his study/ problem.

AIM:

To impart knowledge on Non Destructive Testing procedures.

OBJECTIVES :

1. To understand principle behind various NDT techniques.
2. To study about NDT equipments and accessories.
3. To learn working procedures of various NDT techniques.

UNIT I Non-Destructive Testing: An Introduction 11

Introduction to various non destructive methods- Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II Liquid Penetrant Testing, Magnetic Particle Testing 12

Physical principles, procedure for penetrant testing,Penetrant Testing materials, Penetrant testing methods - water washable, post - Emulsifiable methods, Applications,Principle of MPT, procedure used for testing a component , Equipment used for MPT , Applications.\

UNIT III Eddy Current Testing, Acoustic Emission 12

Principles, Instrumentation for ECT, Absolute - differential probes, Techniques - High sensitivity Techniques, Applications,Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.

UNIT IV Ultrasonic Testing 12

Fundamentals of wave theory-Principle , Ultrasonic transducers ,Inspection Methods, Normal Inscudent Pulse - Echo Inspection , Through - transmission Testing , angle Beam Pulse - Echo testing , Techniques for Normal Beam Ispection , Ultrasonic Flaw detection Equipment , Modes of display A-scan , B-Scan , C- Scan ,Applications.

UNIT V Radiography ,Comparison and selection of NDT methods 13

Basic principle, Effect of radiation on Flim, Radiographic imaging , Inspection Techniques - Single wall sigle image , Double wall Penetration , Multiwall Penetration technique.Comparison and selection of various NDT techniques.

TOTAL:60

REFERENCES:

1 Krautkramer. J., "Ultra Sonic Testing of Materials", 1st Edition, Springer Verlag Publication, New York, 1996.

2 Peter J. Shull "Non Destructive Evaluation: Theory, Techniques and Application" Marcel Dekker, Inc., New York, 2002

3 Birchan.B, "Non-Destructive Testing", Oxford, London, 1975

4 Baldev Raj and B.Venkataraman, "Practical Radiology", Narosa Publishing House, 2004

5. Baldev raj, T Jeyakumar, M. Thavasimuthu "Practical Non Destructive Testing" Narosa publishing house, New Delhi, 2002

WEB REFERENCE

www.ndt.net .

PCD 717 MACHINE TOOL CONTROL AND CONDITION MONITORING

L	T	P	C
4	0	0	4

Goal

To introduce various types of machine tool control and various condition monitoring techniques.

Objectives

The course should enable the students to

1. Learn the overview of automatic controls in machine tools.
2. Learn the principles drive system and feedback devices of machine tools.
3. Learn the concepts of adaptive control and PLC.
4. Learn the monitoring methods of machine tools.

Outcome

The students should be able to

1. Gain the knowledge on various automatic control modules used in machine tools.
2. Gain the knowledge on actuators and feedback drives.
3. Gain the knowledge on various adaptive systems and their constraints.
4. Gain the knowledge on vibration, acoustic emission based monitoring systems and other monitoring methods.

AIM:

To impart knowledge on machine tool control and conditioning monitoring.

OBJECTIVE:

To introduce various types of machine tool control and various condition monitoring techniques.

UNIT - I OVERVIEW OF AUTOMATIC CONTROL IN MACHINE TOOLS 14

Open loop and closed loop system in machine tools- process model formulation-transfer function-control actions-block diagram representation of mechanical pneumatic and electrical systems. Process computer - peripherals-Data logger-Direct digital control-Supervisory computer control.

UNIT - II DRIVE SYSTEMS AND FEED BACK DEVICES IN MACHINE TOOLS 12

Hydraulic and Pneumatic drives, Electrical drives - A.C. Motor, D.C. Motor, Servo motor and Stepper motor. Feed back devices - Synchro, resolver, diffraction gratings, potentiometer, Inductosyn and encoders-application in machine tools.

UNIT - III ADAPTIVE CONTROL AND PLC 13

Adaptive control-types - ACC, ACO, Real time parameter estimation, Applications - adaptive control for turning, milling, grinding and EDM. Programmable logic controller-Functions-Applications in machine tools.

UNIT - IV VIBRATION, ACOUSTIC EMISSION / SOUND 11

Fundamentals of wave theory, Primary & Secondary signals, Online and Off-line monitoring. Fundamentals of Vibration, Sound, Acoustic Emission. Machine Tool Condition Monitoring through Vibration, Sound, Acoustic Emission, Case Studies

UNIT - V CONDITION MONITORING, THROUGH OTHER TECHNIQUES 10

Visual & temperature monitoring, Leakage monitoring, Lubricant monitoring, condition monitoring of Lube and Hydraulic systems, Thickness monitoring, Image processing techniques in condition monitoring.

TOTAL: 60

REFERENCES:

1. Manfred Weck, "Hand Book of Machine Tools" -Vol.3, John Wiley & Sons, 1984.
2. Sushil Kumar Srivstava, "Industrial Maintenance Management"S.Chand & Company Ltd., New Delhi,1998.
3. Mikell P.Groover, "Automation Production system and Computer Integrated Manufacturing", Prentice Hall of India Pvt. Ltd., 1995.

PCD 718 FAILURE ANALYSIS

L	T	P	C
4	0	0	4

Goal

- To impart in depth knowledge of the various Quality Engineering tools used in the analysis of product/ process Failures to enable him to design Robust product/ process Which will not fail in its intended functions during its design Life period.
- To develop a Pro active designer rather than a reactive one.

Objectives

The course should enable the students to:

1. Failure of products/ processes and of the Tools which will enable him to solve these These problems.
2. Predict before hand the causes for failures and incorporate the remedial measures in the design stage itself rather than doing a post mortem exercise.
3. Understand the importance of fixing geometrical and parametrical tolerances and other quality related specifications on the product drawing without any ambiguity.
4. Acquire knowledge in managing quality issues during product design through analytical route.

Outcome

The students should be able to understand

1. The concepts of various Quality Engineering tools and how to use them Effectively in the design of products.
2. without any ambiguity the theory and concepts of various tools used in Failure analysis.
3. The evaluation a product in case of a failure
4. The testing and management of reliability risk analysis and Reliability Monitoring.

UNIT I INTRODUCTION **11**

Basic Probability-concept and various distributions, Concept of Reliability andanalysis of various configurations of assemblies and sub-assemblies. Series, Paralleland other grouping. System reliability, Set theory, optimal Cut Set and Tie Set, 'stardelta'method, matrix method etc.

UNIT II PRODUCT FAILURE THEORY **12**

System reliability determination through 'Event Tree' analysis and Fault Tree ,Analysis (FTA), Failure Modes and Effects Analysis (FMEA), Failure Modes, Effects and Criticality Analysis (FMECA). R.P.N, Graph theory, etc.

UNIT III RELIABILITY PREDICTION MODELS **12**

Series and parallel systems - RBD approach - Standby systems - m/n configuration - Application of Baye's theorem - cut and tie set method - Markov analysis. Optimal allocation of component reliability

to achieve maximum system reliability - various techniques and methods such as Proportional, Conditional, Agree, Arinc, etc.

UNIT IV RELIABAILITY EVALUATION **12**

Concept of loading roughness, probability in design including evaluation of safety margin. Reliability of Engineering Design; Mean, Median & K statistics for Reliability evaluation (non parametric, Short Sample).

UNIT V RELIABILITY MANAGEMENT **13**

Reliability testing - Reliability growth monitoring - Non parametric methods - Reliability and life cycle costs - Reliability allocation - Replacement model.Case Studies Diagnostic maintenance through ferrography, Vibration Signature, SOAP and other programme. Case studies done in Indian perspectives using Short Sample, nonparametric reliability.

TOTAL: 60

References:

1. Gupta AK, Reliability engineering and tero-technology, Macmillan India Ltd, Delhi
2. Srinath LS, Reliability Engineering, Affiliated East-West Press Pvt Ltd, Delhi
3. Connor PDT, Practical Reliability Engineering, John Wiley & Sons Ltd, Singapore
4. Modarres, "Reliability and Risk analysis ", Mara Dekker Inc., 1993.
5. John Davidson, The Reliability of Mechanical system, The Institution of Mechanical Engineers, London, 1988.
6. Smith C.O." Introduction to Reliability in Design", McGraw Hill, London.
7. "Reliability Engineering and Risk Analysis,2nd edition Taylor & Francis.

PTE 103- ADVANCED FLUID MECHANICS

L	T	P	C
4	1	0	4

Goal

The goal of the programme is to provide advance concepts for ideal and non ideal flows, to impart the knowledge of various types of flow like two dimensional flow, turbulent flow and compressible flow through ducts and to provide the details shock waves.

Objectives

The course should enable the students to:

1. To understand advance concepts for ideal and non ideal flows.
2. To understand various types of flow like two dimensional flow, turbulent flow and compressible flow through ducts.
3. To understand the details of shock waves.

Outcome

The students should be able to:

1. To know advance concepts for ideal and non ideal flows.
2. To get the knowledge of various types of flow like two dimensional flow, turbulent flow and compressible flow through ducts.
3. To know the details of shock waves.

UNIT - I INTRODUCTION **12**

Ideal and non-ideal flows, general equations of fluid motion, Navier - stokes equations and their exact solutions. Boundary layer theory, wedge flows, laminar flow over plates and through cylinders.

UNIT - II TWO DIMENSIONAL FLOW **12**

Subsonic flow, physical significance of irrotational motion - Kelvin's theorem - Differential equation in terms of velocity Potential and stream function - Flow with small purtubaration - flow past a wave shaped wall - Gothert's rule - Prandtl Glanert rule - Hodograph method

UNIT - III TURBULENT FLOW **12**

Turbulence, models and flow equations: steady and unsteady turbulent boundary layers.

UNIT - IV COMPRESSIBLE FLOW THROUGH DUCTS **12**

Introduction to compressible viscous flow, governing equations, flow with friction flow with heat transfer flow though nozzle and diffusers.

UNIT - V SHOCK WAVE **12**

Normal and oblique shocks - Prandtl - Meyer expansion - Rankine - Hugnoit relation, Application of method of characteristics applied to two dimensional case - simple supersonic wind tunnel Design of supersonic wind tunnel and nozzle.

TUTORIAL: 15,

TOTAL: 60

REFERENCES

1. T Radhakrishnan - Gas Dynamics, Prentice Hall, New Delhi.
2. Mohanty A K- Fluid Mechanics, Prentice Hall of India, 1986
3. Shapiro A F -The Dynamics of Compressible flow Vol 1, The Ronald Press company 1963
4. Shames- Mechanics of Fluids, Megraw-Hill Inc
5. Schlichting H - Boundary layer theory, McGraw Hill-Inc
6. Yahya S.M, "Fundamentals of Compressible flow", New Age International (P) Ltd.New Delhi,1996.

PCD 719 - QUANTITATIVE AND QUALITATIVE RESEARCH

L	T	P	C
4	0	0	4

Goal

To make students to understand and interpret research reports when you read them, indentifying their major elements and underlying methodologies.

Objectives

The course should enable the students to:

1. Identify different research methods and these are compatible with different situations, and therefore it is important to know which method is best suitable for use with a particular hypothesis or question.
2. Get exposure to unanswered questions or exploring which currently not exist in a research.

Outcome

The students should be able to:

1. Identify the major differences between qualitative and quantitative research.
2. Describe the pros and cons of using qualitative data collection techniques.
3. Understand in-depth interviewing and focus groups as questioning techniques.
4. Discuss observation methods and explain how they are used to collect primary data.

UNIT I RESEARCH METHODOLOGY

Types of research- Literature survey- Patent survey- literature review reporting- ethics and interventions of research- planning for research- research tools- seven management tools-graphical representations - Codes - Standards.

UNIT II QUANTITATIVE METHODS **10**

Descriptions-statistics-distribution-sampling - hypothesis testing - regression-ANOVA - reliability-validity- uncertainty - sensitivity analysis- use of SPSS.

UNIT III QUALITATIVE METHODS **10**

Historical analogy-market research- survey-analysis- delphi methodology-determination of index-life cycle analysis - modeling and simulation.

UNIT IV MEASUREMENT IN RESEARCH **12**

Need for measurement- types of measuring instruments- configurations and functional descriptions of instruments- performance- characteristics- static and dynamic characteristics-manipulation, transmission and recording of data- data acquisition and processing systems-Computer aided experimentation.

UNIT V RESEARCH REPORT PREPARATION **5**

Principles of Written communication- content preparation- synopsis writing- result analysis-discussion section-case studies.

REFERENCES

1. Robert B. Burns, Introduction to Research methods, SAGE Publications London- 2000
2. Herman J. Ader, Gidon J. Mellenbergh, Research Methodology, SAGE Publications London- 1999
3. Jeremy Miles& Mark Sherlin, Applying Regression and Correlation, A Guide for students and researchers SAGE Publications London- 2008.
4. Ernest O. Doebelin, Measurement Systems- Application, 5th Edition , 2007.