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

CURRICULUM
&
SYLLABUS 2013-14

B.Tech.
MECHANICAL ENGINEERING

ACADEMIC REGULATIONS (B.Tech)

(Full /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 Aims and Objectives of the Institute are focused on

- Providing world class education in engineering, technology, applied sciences and management.
- Keeping pace with the ever changing technological scenario to help the 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 B.Tech programme will be decided by BOM as per the directives from 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 (i) Full-Time :

At the time of applying for admission, the candidates should have passed / appeared and be awaiting results of the final examination of the 10+2 system or its equivalent with Mathematics, Physics and Chemistry as subjects of study.

(ii) Part -Time:

At the time of applying for admission, the candidates should have a Diploma in Engineering/Technology in the relevant branch of specialization awarded by the State Board of Technical Education, Tamil Nadu or any other authority accepted by the Board of Management of the University as equivalent thereto and a minimum of one year practical experience.

2.3 The selected candidates will be admitted to the B.Tech. programme after he/she fulfills all the admission requirements set by the Institute and after the payment of the prescribed fees.

2.4 In all matters relating to admission to the B.E. / B.Tech. 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) A general (common) core programme comprising basic sciences, engineering sciences, humanities, technical arts and mathematics.

ii) An engineering core programme introducing the student to the foundations of engineering in the respective branch.

iii) An elective programme enabling the student to opt and undergo a set of courses of interest to him/ her.

iv) Professional practice including project, seminar and industrial training.

v) General elective courses, such as, Environmental Studies, Physical Education, Professional ethics, and National Service Scheme.

The distribution of total credits required for the degree programme into the above five categories will nominally be 20%, 50%, 15%, 5%, and 10% respectively.

3.2 (i) Full-Time:

The duration of the programme will be a minimum of 8 semesters. Every branch of the B.E. / B.Tech. programme will have a curriculum and syllabi for the courses approved by the Academic Council.

ii) Part - Time:

The duration of the programme will be a minimum of 7 semesters. Every branch of the B.Tech. programme will have a curriculum and syllabi for the courses approved by the Academic Council

3.3 The academic programmes of the Institute follow the credit system. The general pattern is:

- One credit for each lecture hour per week per semester;
- One credit for each tutorial hour per week per semester;
- Two credits for each laboratory practical/ drawing of three hours per week per semester.
- One credit for 4 weeks of industrial training and
- One credit for 4 hours of project per week per semester

3.4 (i) Full-Time:

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 of 190-200.

(ii) Part-Time:

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 of 110-120.

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 and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i " and the grade points Pi 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 the 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 Enrolment

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 and 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) Full -Time:

A full time student shall not register for less than 16 credits or more than 30 credits in any given semester.

(ii) Part -Time:

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. Continuation of 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/her parents regarding the shortage of his/her credit will be sent by the HOD after the announcement of the results of the university examinations.

10. Maximum duration of the programme

10.1 (i) Full - Time

The normal duration of the programme is eight semesters. However a student may complete the programme at a slower pace by taking more time, but in any case not more than 14 semesters excluding the semesters withdrawn on medical grounds or other valid reasons.

(ii) Part - Time

The normal duration of the programme is seven semesters. However a student may complete the programme at a slower pace by taking more time, but in any case not more than 12 semesters excluding the semesters withdrawn on medical grounds or other valid reasons

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 a 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% in a semester is not eligible to appear for the end-semester examination for that semester. The details of all students who have less than 75% attendance in a course 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	10%	-
Attendance	10%	
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%.

14.4 For courses on Physical Education, NSS, etc the assessment will be as satisfactory/not satisfactory only.

15. Make up Examination/Model Exam

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 examination 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 examination, 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 Registrar / Controller of examination. 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.

(ii) To be Eligible to appear for the end semester examinations for a particular course, a candidate will have to secure a minimum of 40% marks in the sessional for that course.

(iii) Candidates are required to obtain all credits assigned to the first two semesters of the programme within the first four semesters of the programme. Candidates failing to satisfy this requirement will not be allowed to proceed to the fifth semester until the condition is satisfied. Further, candidates will not be allowed to proceed to seventh

semester if they have not cleared all the courses assigned during third & fourth semesters.

17.2 After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of UG 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, and 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 Director(Academic) with a copy marked to 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 After ten semesters, the sessional marks of the candidate will not be considered for a pass in a course. A candidate who secures 50% in the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

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 for the award of the degree having passed the examination in all the courses **within 10 semesters.**

(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 consulted 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.

20.2 The Academic Council may also approve admission of lateral entry (who hold a diploma in Engineering/ technology) candidates with advance credit based on the recommendation of the transfer of credits committee on a case to case basis.

21. Eligibility for the award of B.Tech. Degree

21.1. A student will be declared to be eligible for the award of the B.Tech. Degree if he/she has

i) registered and successfully acquired the credits for 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. Change of Branch

22.1 If the number of students in any branch of B.Tech. class as on the last instructional day of the First Semester is less than the sanctioned strength, then the vacancies in the said branches can be filled by transferring students from other branches. All such transfers will be allowed on the basis of merit of the students. The decision of the Chancellor shall be final while considering such requests.

22.2 All students who have successfully completed the first semester of the course will be eligible for consideration for change of branch subject to the availability of vacancies.

23. Power to modify

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

HINDUSTAN UNIVERSITY

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

DEPARTMENT OF MECHANICAL ENGINEERING

Semester I

(Common to all Branches)

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	EL 2101	Technical English	3	0	0	3	3
2	MA 2101	Engineering Mathematics- I	3	1	0	4	4
3	PH2001/ CY2001	Engineering Physics / Engineering Chemistry*	3	0	0	3	3
4	ME2101	Engineering Graphics	1	0	3	3	4
5	CS2101	Computer Programming	3	0	0	3	3
PRACTICAL							
6.	CS2131	Computer Programming Laboratory	0	0	3	2	3
7.	GE2131	Engineering Practices Laboratory - I	0	0	3	2	3
8.	EL2131	Communication Skills Laboratory -I	0	0	3	2	3
9.	PH 2031 CY 2031	Physics Laboratory / Chemistry Laboratory*	1	0	3	3	4
		Total				**25**	**30**

Note: * Depending upon the number of batches, it will be alternated between semesters 1 & 2

Semester II

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MA 2201	Engineering Mathematics - II#	3	1	0	4	4
2	CY 2001 PH 2001	Engineering Chemistry / Engineering Physics* #	3	0	0	3	3
3	ME 2201	Engineering Mechanics**	3	1	0	4	4
4	ME 2202	Manufacturing Technology - I	3	0	0	3	3
5	EE 2212	Basic Electrical Engineering	3	1	0	4	4

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
Practical							
7	CY 2031 P H2031	Chemistry Laboratory / Physics Laboratory* #	1	0	3	3	4
8	GE 2231	Engineering Practices Laboratory - II #	0	0	3	2	3
9	EE 2235	Electrical Engineering Lab	0	0	3	2	3
10	EL 2231	Communication Skills Lab-II #	2	0	2	3	4
		Total				**28**	**32**

Note:

*** Depending upon the number of batches, it will be alternated between semesters 1 & 2**

 # Common to all Branches

**** Common to Automobile and Mechanical Engineering**

Semester III

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MA2301	Engineering Mathematics - III *	3	1	0	4	4
2	ME 2301	Engineering Thermodynamics	3	1	0	4	4
3	ME 2302	Fluid Mechanics	3	1	0	4	4
4	ME 2303	Manufacturing Technology - II	3	0	0	3	3
5	ME 2304	Metrology & Measurements	3	0	0	3	3
PRACTICAL							
6	ME 2331	Fluid Mechanics Lab	0	0	3	2	3
7	ME 2332	Manufacturing Technology Lab	0	0	3	2	3
8	ME 2333	Metrology and Measurements Lab	0	0	3	2	3
9	ME 2334	Machine Elements and Assembly Drawing	2	0	2	3	4
		Total				**27**	**31**

*** Common to Aeronautical, Automobile, Mechanical Engineering**

Semester IV

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MA 2401	Numerical Methods*	3	1	0	4	4
2	EC 2411	Electronics and Microprocessor	3	0	0	3	3
3	ME 2401	Thermal Engineering	3	1	0	4	4
4	ME 2402	Strength of Materials**	3	1	0	4	4
5	ME 2403	Mechanics of Machines - I	3	1	0	4	4
PRACTICAL							
6	EC 2435	Electronics and Microprocessor Lab	0	0	3	2	3
7	ME 2431	Thermal Engineering Lab - I	0	0	3	2	3
8	ME 2432	Strength of Materials Lab**	0	0	3	2	3
9	ME 2433	Project Work	0	0	6	2	6
		Total				**27**	**34**

***Common to Civil, Aeronautical, Mechanical Engineering**
****** Common to Automobile and Mechanical Engineering**

Semester V

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	ME 2501	Design of Machine Elements	3	1	0	4	4
2	ME 2502	Mechanics of Machines - II	3	1	0	4	4
3	ME 2503	Gas Dynamics and Jet Propulsion	3	1	0	4	4
4	ME 2504	Engineering Materials and Metallurgy	3	0	0	3	3
5	ME 2505	Applied Hydraulics and Pneumatics	3	0	0	3	3
6	ME 2506	Fluid Machinery	3	1	0	4	4
PRACTICAL							
7	ME 2531	Dynamics Lab	0	0	3	2	3
8	ME 2532	Fluid Machinery Lab	0	0	3	2	3
9	ME 2533	CAM Lab	0	0	3	2	3
		Total				**28**	**31**

Semester VI

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MG 2001	Principles of Management*	3	0	0	3	3
2	CY 2002	Environmental Science and Engineering**	3	0	0	3	3
3	ME 2601	Design of Transmission System	3	1	0	4	4
4	ME 2602	Heat Transfer	3	1	0	4	4
5	ME 2603	Industrial Automation & Robotics	3	0	0	3	3
6	ME 2604	I.C. Engine and Steam Turbine	3	0	0	3	3
PRACTICAL							
7	ME 2631	Thermal Engineering Lab- II	0	0	3	2	3
8	ME 2632	Heat Transfer Lab	0	0	3	2	3
9	EL2431	Communication Skills & Personality Development Lab - III	2	0	2	3	4
10	ME 2633	Design Project - I	0	0	6	2	6
		Total				**29**	**36**

*** Common to Civil, Automobile, Mechanical Engineering**

**** Common to Automobile, Aeronautical, Electronics & Instrumentation, Mechanical Engineering**

Semester VII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MG 2002	Total Quality Management*	3	0	0	3	3
2	ME 2701	Finite Element Methods	3	1	0	4	4
3	ME 2702	Mechatronics	3	0	0	3	3
4	ME 2703	Power Plant Engineering	3	0	0	3	3
5		Elective - I	3	0	0	3	3
6		Elective - II	3	0	0	3	3
PRACTICAL							
7	ME 2731	Computer Aided Simulation and Analysis Lab	0	0	3	2	3
8	ME 2732	Mechatronics Lab	0	0	3	2	3
9	ME 2733	Design Project - II & Comprehensive Viva Voce	0	0	6	2	6
		Total				**25**	**31**

*Common to Automobile, Aeronautical, Civil, Electronics & Instrumentation, Mechanical Engineering

Semester VIII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1		Elective - III	3	0	0	3	3
PRACTICAL							
2	ME 2831	Project & Viva voce	0	0	24	6	24
		Total				**9**	**27**

ELECTIVE COURSES - VII SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	MG 2004	Marketing Management	3	0	0	3	3
2	ME 2751	Unconventional Machining Processes	3	0	0	3	3
3	ME 2752	Refrigeration and Air-conditioning	3	0	0	3	3
4	ME 2753	Renewable Sources of Energy	3	0	0	3	3
5	ME 2754	Mechanical Vibration	3	0	0	3	3
6	ME 2755	Quality Control and Reliability Engineering**	3	0	0	3	3
7	ME 2756	Design of Jigs, Fixtures and Press Tools	3	0	0	3	3
8	ME 2757	Computational Fluid Dynamics**	3	0	0	3	3
9	ME 2758	Modern Concepts of Engineering Design	3	0	0	3	3
10	ME 2759	Thermal Turbo Machines	3	0	0	3	3
11	ME 2760	Composite Materials and Structures	3	0	0	3	3
12	ME 2761	Process Planning & Control	3	0	0	3	3
13	ME 2762	Dynamics and Control	3	0	0	3	3
14	ME 2763	Marine Propellers and Propulsion	3	0	0	3	3
15	ME 2764	Operations Research	3	0	0	3	3
16	ME 2765	Computer Integrated Manufacturing	3	0	0	3	3

**** Common to Automobile and Mechanical Engineering**

ELECTIVE COURSES - VIII SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
1	GE 2001	Professional Ethics and Human Values*	3	0	0	3	3
2	MG 2003	Entrepreneurship Development**	3	0	0	3	3
3	MG 2005	Engineering Economics and Cost Analysis***	3	0	0	3	3
4	ME 2851	Production Planning and Control	3	0	0	3	3
5	ME 2852	Advanced Strength of Materials	3	0	0	3	3
6	ME 2853	New Product Design and Development	3	0	0	3	3
7	ME 2854	Maintenance Engineering	3	0	0	3	3
8	ME 2855	Non-destructive Testing Methods	3	0	0	3	3
9	ME 2856	Advanced IC Engineering	3	0	0	3	3
10	ME 2857	Engineering Design and Analysis	3	0	0	3	3

*** Common to Civil, Aeronautical, Mechanical Engineering**
****Common to EIE, Mechanical Engineering**
***** Common to Automobile and Mechanical Engineering**

SEMESTER WISE

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
THEORY							
		Semester I				25	30
		Semester II				28	32
		Semester III				27	31
		Semester IV				27	34
		Semester V				28	31
		Semester VI				29	36
		Semester VII				25	31
		Semester VIII				09	27
		TOTAL CREDITS				**198**	**252**

SEMESTER - I

EL 2101 TECHNICAL ENGLISH

L	T	P	C
3	0	0	3

GOAL

The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their workplace or living space; to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

OBJECTIVES

The course should enable the students to:

1. Widen the capacity of the learners to listen to English language at the basic level and understand its meaning.
2. Enable learners to communicate in an intelligible English accent and pronunciation.
3. Assist the learners in reading and grasping a passage in English.
4. Learn the art of writing simple English with correct spelling, grammar and punctuation.
5. Cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

OUTCOME

The students should be able to:

1. Have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
3. Read, comprehend and answer questions based on literary, scientific and technological texts.
4. Write instructions, recommendations, checklists, process-description, letter-writing and report writing.
5. Have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.

UNIT I LISTENING SKILL **9**

Listening to the sounds, silent letters & stress in English words & sentences - Listening to conversation & telephonic conversation -- Listening for general meaning & specific information -- Listening for positive & negative comments - Listening to technical topics - Listening to prose & poetry reading - - Listening exercises.

Embedded language learning: Sentence definition -- Spelling & punctuation -- Imperative form - Sequencing of sentences -- Gerunds -- Infinitives -- 'Wh-'questions.

UNIT II SPEAKING SKILL **9**

Self-introduction - Expressing personal opinion - Dialogue - Conversation - Simple oral interaction -- Speaking on a topic -- Expressing views for & against -- Speaking on personal topics like hobbies, topics of interest, present & past experiences, future plans - Participating in group discussions, role plays, debates, presentations, power-point presentations & job-interviews.

Embedded language learning: Adverbs -Adjectives - Comparative and Numerical adjectives -- Nouns & compound nouns -- Prefixes and suffixes.

UNIT III READING SKILL **9**

Reading anecdotes, short stories, poems, parts of a novel, notices, message, time tables, advertisements, leaflets, itinerary, content page - Reading pie chart & bar chart -- Skimming and scanning -- Reading for contextual meaning - Scanning for specific information -- Reading newspaper & magazine articles - Critical reading -- Reading-comprehension exercises.

Embedded language learning: Tenses - Active and passive voice -- Impersonal passive -- Words and their function -- Different grammatical forms of the same word.

UNIT IV WRITING SKILL **9**

Writing emails, notes, messages, memos, notices, agendas, advertisements, leaflets, brochures, instructions, recommendations & checklists -- Writing paragraphs -- Comparisons & contrasts - Process description of Flow charts - Interpretation of Bar charts & Pie charts - Writing the minutes of a meeting -- Report writing -- Industrial accident reports -- Letter-writing -- Letter to the editors - Letter inviting & accepting or declining the invitation - Placing orders - Complaints -- Letter requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letters of application for a job, enclosing a CV or Resume - Covering letter.

Embedded language learning: Correction of errors - Subject-verb Concord -- Articles - Prepositions - - Direct and indirect speech.

UNIT V THINKING SKILL **9**

Eliciting & imparting the knowledge of English using thinking blocks - Developing thinking skills along with critical interpretation side by side with the acquisition of English -- Decoding diagrams & pictorial representations into English words, expressions, idioms and proverbs.

Embedded language learning: General vocabulary -- Using expressions of cause and effect -- Comparison & contrast -- If-conditionals -- Expressions of purpose and means.

REFERENCES

1. Norman Whitby. Business Benchmark: Pre-Intermediate to Intermediate - BEC Preliminary. New Delhi: Cambridge University Press, 2008 (Latest South Asian edition).
2. Devaki Reddy & Shreesh Chaudhary. Technical English. New Delhi: Macmillan, 2009.
3. Rutherford, Andrea J. Basic Communication Skills for Technology. 2nd edition. New Delhi: Pearson Education, 2006.

MA 2101 ENGINEERING MATHEMATICS I

L	T	P	C
3	1	0	4

GOAL

To create the awareness and comprehensive knowledge in engineering mathematics.

OBJECTIVES

The course should enable the students to:

1. Find the inverse of the matrix by using Cayley Hamilton Theorem and Diagonalisation of matrix using transformation.
2. Understand the Evolutes and Envelope of the curve.
3. Learn the solutions of second order linear differential equations of standard types and Legendre's linear differential equation.
4. Learn partial differentiations involving two and three variables and expansions of functions using Taylor series.
5. Learn the expansions of trigonometric, hyperbolic functions and their relations.

OUTCOME

The students should be able to:

1. Identify Eigen value problems from practical areas and obtain its solutions and using transformation diagonalising the matrix which would render Eigen values.
2. Find out effectively the geometrical aspects of curvature and appreciates mathematical skills in constructing evolutes and envelopes in mechanics and engineering drawing.
3. Recognize and to model mathematically and solving, the differential equations arising in science and engineering.
4. Understand and model the practical problems and solve it using maxima and minima as elegant applications of partial differentiation.
5. Acquire skills in using trigonometric and hyperbolic and inverse hyperbolic functions.

UNIT I MATRICES **12**

Review: Basic concepts of matrices-addition, subtraction, multiplication of matrices - adjoint -inverse - solving cubic equations.

Characteristic equation - Properties of Eigen values - Eigen values and Eigen vectors - Cayley Hamilton theorem (without proof) - Verification and inverse using Cayley Hamilton theorem. Diagonalisation of matrices - Orthogonal matrices - Quadratic form - Reduction of symmetric matrices to a Canonical form using orthogonal transformation - Nature of quadratic form

UNIT II DIFFERENTIAL CALCULUS **12**

Review: Basic concepts of differentiation - function of function, product and quotient rules.

Methods of differentiation of functions - Cartesian form - Parametric form - Curvature - Radius of curvature - Centre of curvature - Circle of curvature. Evolutes of parabola, circle, ellipse, hyperbola and cycloid - Envelope.

UNIT III ORDINARY DIFFERENTIAL EQUATIONS **12**

Review: Definition, formation and solutions of differential equations.

Second order differential equations with constant coefficients - Particular integrals - , eaxCosbx, eaxSinbx. Euler's homogeneous linear differential equations - Legendre's linear differential equation - Variation of parameters.

UNIT IV PARTIAL DIFFERENTIATION **12**

Partial differentiation - differentiation involving two and three variables - Total differentiation -Simple problems. Jacobian - verification of properties of Jacobians - Simple problems. Taylor's series - Maxima and minima of functions of two and three variables.

UNIT V TRIGONOMETRY **12**

Review: Basic results in trigonometry and complex numbers - De Moivre's theorem.

Expansions of sinn , cosn , tann where n is a positive integer. Expansions of in terms of sines and cosines of multiples of where m and n are positive integers. Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers - Separation of complex functions into real and imaginary parts - Simple problems.

Note: Questions need not be asked from review part.

TOTAL: 60

TEXT BOOKS

1. Erwin Kreyzig, A Text book of Engineering Mathematics, John Wiley, 1999.
2. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.
3. Chandrasekaran A, A Text book of Engineering Mathematics I, Dhanam Publications, Chennai, 2010.

REFERENCES

1. Venkataraman M.K, Engineering Mathematics, Volume I, The National Publishing Company, Chennai, 1985.
2. Kandaswamy P, Thilagavathy K and Gunavath K, Engineering Mathematics, Volume I & II, S.Chand and Company, New Delhi, 2005.
3. Bali N.P, Narayana Iyengar. N.Ch., Engineering Mathematics, Laxmi Publications Pvt. Ltd, New Delhi, 2003
4. Veerarajan T, Engineering Mathematics (for first year), Fourth Edition, Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.

PH2001 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

GOAL

To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES

The course should enable the students to:

1. Develop strong fundamentals of properties and behaviour of the materials
2. Enhance theoretical and modern technological aspects in acoustics and ultrasonics.
3. Enable the students to correlate the theoretical principles with application oriented study of optics.
4. Provide a strong foundation in the understanding of solids and materials testing.
5. Enrich the knowledge of students in modern engineering materials.

OUTCOME

The students should be able to:

1. Understand the properties and behaviour of materials.
2. Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonics and be able to employ it as an engineering tool.
3. Understand the concept, working and application of lasers and fiber optics.
4. Know the fundamentals of crystal physics and non destructive testing methods.
5. Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER **9**

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II ACOUSTICS AND ULTRASONICS **9**

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriction and Piezoelectric methods - properties - applications of ultrasonics with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS **9**

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

UNIT IV CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING **9**

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS **9**

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis -Properties and applications.

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - uses of superconductors.

TOTAL : 45

TEXT BOOKS

1. Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpat rai publications (P) Ltd., New Delhi 2010.
2. P.Mani, "Engineering Physics", Vol-I, Dhanam Publications, Chennai 2011.
3. Rajendran V. an Marikani A., "Applied Physics for engineers" , 3rd edition, Tata Mc Graw -Hill publishing company Ltd., New Delhi,2003.

REFERENCES

1. Uma Mukherji, Engineering Physics, Narosa publishing house, New Delhi, 2003.
2. Arumugam M., Engineering Physics, Anuradha agencies, 2007.
3. Palanisamy P.K., Engineering Physics, SciTech Publications, Chennai 2007.
4. Arthur Beiser, Concepts of Modern Physics, Tata Mc Graw -Hill Publications, 2007.
5. P.Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley India, 2007

CY 2001 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

GOAL

To impart basic principles of chemistry for engineers.

OBJECTIVES

The course should enable the students to

1. Make the students conversant with the basics of
   (a) Water technology And (b) Polymer science
2. Provide knowledge on the requirements and properties of a few important engineering materials.
3. Educate the students on the fundamentals of corrosion and its control.
4. Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
5. Create an awareness among the present generation about the various conventional energy sources.

OUTCOME

The students should be able to

1. Gain basic knowledge in water analysis and suitable water treatment method.
2. Get an idea on the type of polymers to be used in engineering applications.
3. Get awareness about new materials
4. Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
5. Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
6. Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY 9

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys - Definition, Examples

UNIT II ENGINEERING MATERIALS 9

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications.-

Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives - Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III ELECTROCHEMISTRY AND CORROSION **9**

Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) - Constituents of Paints and varnish.

UNIT IV CHEMICAL THERMODYNAMICS **9**

Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy - heat capacity - work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics - entropy change - phase transformations and entropy change - problems - Work Function & Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.

UNIT V FUELS AND ENERGY SOURCES **9**

Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas -Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell -Secondary Cell - Nickel Cadmium Battery - Fuel Cells - Hydrogen -Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy - Light water nuclear power plant.

TOTAL : 45

TEXT BOOKS

1. S. S. Dara, Text Book of Engineering Chemistry, S. Chand & Company Ltd., New Delhi, 2003
2. Murthy, Agarwal & Naidu, Text Book of Engineering Chemistry, BSP, 2003.
3. S.Sumathi, Engineering Chemistry, Dhanam Publications, 2008.
4. S.Sumathi and P.S.Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004

3. A. Gowarikar, Text Book of Polymer Science, 2002

4. Kuriacose & Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004

5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

ME 2101 ENGINEERING GRAPHICS

L	T	P	C
1	0	3	3

GOAL

To develop graphical skills for communicating concepts, ideas and designs of engineering products and to give exposure to national standards relating to technical drawings.

OBJECTIVES

The course should enable the students to

1. Introduce drawing standards and use of drawing instruments.
2. Introduce first angle projection.
3. Practice of engineering hand sketching and introduce to computer aided drafting
4. Familiarize the students with different type of projections.
5. Introduce the process of design from sketching to parametric 3D CAD and 2D orthographic drawings to BIS

OUTCOME

The students should be able to

1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineering artifact

Note: Only first angle projection is to be followed

BASICS OF ENGINEERING GRAPHICS **2**

Importance of graphics Use of drawing instruments - BIS conventions and specifications - drawing sheet sizes, layout and folding - lettering - Dimensioning-Geometrical constructions - Scales. Construction of curves like ellipse, parabola, cycloids and involutes.

UNIT I PROJECTION OF POINTS, LINES AND SURFACES **15**

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic

projection - Naming views as per BIS - First angle projection. Projection of points. Projection of straight lines located in first quadrant using rotating line(using method only). Projection of plane surfaces like polygonal lamina and circular lamina. Drawing views when the surface of the lamina is inclined to one reference plane.

UNIT II PROJECTION OF SOLIDS **10**

Projections of simple solids like prism, pyramid, cylinder and cone - Drawing views when the axis of the solid is inclined to one reference plane. Introduction to 'section of solids'.

UNIT III DEVELOPMENT OF SURFACES **10**

Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

UNIT IV ORTHOGRAPHIC PROJECTIONS **10**

Orthographic projections - Conversion to orthographic views from given pictorial views of objects, including dimensioning. Free hand sketching of Orthographic views from Pictorial views.

UNIT V PICTORIAL PROJECTIONS **10**

Isometric projection - Isometric scale - Isometric views of simple solids like prisms, pyramids, cylinders and cones. Introduction to perspective Projections.

COMPUTER AIDED DRAFTING (Demonstration Only) **3**

Introduction to computer aided drafting and dimensioning using appropriate software.

2D drawing commands: Zoom, Picture editing commands, Dimensioning, Isometric drawing, Iso-Planes and 3D drafting. Plotting of drawing. Practice includes drawing the projection of lines and solids. Prepare isometric view of simple solids like prisms, pyramids, cylinders and cones.

TOTAL : 60

TEXT BOOKS

1. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd.,New Delhi, 2010.
2. Warren J. Luzadder and Jon. M.Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2003.

REFERENCES

1. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, Anand-3001, 2007.
2. Thomas E. French, Charles J.Vierck and Robert J.Foster, Engineering Drawing and Graphic Technology, McGraw-Hill Book company 13th Edition.1987.
3. IS 9609 - 1983 Lettering on Technical Drawings.
4. IS 10714 - 1983 General Principles of Presentation of Technical Drawings.
5. IS 11669 - 1986 General Principles of Dimensioning of Technical Drawings.

CS 2101 COMPUTER PROGRAMMING

L	T	P	C
3	0	0	3

GOAL

To introduce computers and programming and to produce an awareness of the power of computational techniques that are currently used by engineers and scientists and to develop programming skills to a level such that problems of reasonable complexity can be tackled successfully.

OBJECTIVES

The course should enable the students to:

1. Learn the major components of a Computer system.
2. Learn the problem solving techniques.
3. Develop skills in programming using C language.

OUTCOMES

The student should be able to:

1. Understand the interaction between different components of Computer system and number system.
2. Devise computational strategies for developing applications.
3. Develop applications (Simple to Complex) using C programming language.

UNIT I COMPUTER FUNDAMENTALS **9**

Introduction - Evolution of Computers - Generations of Computer - Classification of Computers - Application of Computers - Components of a Computer System - Hardware - Software - Starting a Computer (Booting) - Number Systems.

UNIT II COMPUTER PROGRMMING AND LANGUAGES **9**

Introduction - Problem-Solving Techniques: Algorithms, Flowchart, Pseudocode - Program Control Structures - Programming Paradigms - Programming languages - Generations of Programming Languages - Language Translators - Features of a Good ProgrammingLanguages.

UNIT III PROGRAMMING WITH C **9**

Introduction to C - The C Declaration - Operators and Expressions - Input and Output in C - Decision Statements - Loop Control Statements.

UNIT IV FUNCTIONS, ARRAYS AND STRINGS **9**

Functions - Storage Class - Arrays - Working with strings and standard functions.

UNIT V POINTERS, STRUCTURES AND UNION **9**

Pointers - Dynamic Memory allocation - Structure and Union - Files.

TOTAL : 45

TEXT BOOK

1. ITL Education Solution Limited, Ashok Kamthane, "Computer Programming", Pearson Education Inc 2007 (Unit: I to V).

REFERNCES

1. Byron S. Gottfried, "Programming with C", Second Edition, Tata McGraw Hill 2006.
2. Yashvant Kanetkar, "Let us C", Eighth edition, BPP publication 2007.
3. Stephen G.Kochan, "Programming in C - A Complete introduction to the C programming language" , Pearson Education, 2008.
4. T.JeyaPoovan, "Computer Programming Theory and Practice", Vikas Pub, New Delhi

CS 2131 COMPUTER PROGRAMMING LABORATORY
(Common to all branches)

L	T	P	C
0	0	3	2

GOAL

To provide an awareness to develop the programming skills using computer languages.

OBJECTIVES

The course should enable the students to:

1. To gain knowledge about Microsoft office, Spread Sheet.
2. To learn a programming concept in C.

OUTCOME

The students should be able to

1. Use MS Word to create document, table, text formatting and Mail merge options.
2. Use Excel for small calculations using formula editor, creating different types of charts and including pictures etc,
3. Write and execute the C programs for small applications.

LIST OF EXPERIMENTS

a) Word Processing 12

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet 9

5. Chart - Line, XY, Bar and Pie.

6. Formula - formula editor.

7. Spread sheet - inclusion of object, Picture and graphics, protecting the document

c) Programming in C **24**

8. To write a C program to prepare the electricity bill.

9. Functions

(a) Call by value (b) Call by reference.

10. To write a C program to print the Fibonacci series for the given number.

11. To write a C program to find the factorial of number using recursion.

12. To write a C program to implement the basic arithmetic operations using Switch Case statement.

13. To write a C program to check whether the given number is an Armstrong number.

14. To write a C program to check whether the given string is a Palindrome.

15. To write a C program to create students details using Structures.

16. To write a C program to demonstrate the Command Line Arguments.

17. To write a C program to implement the Random Access in Files.

18. To write C programs to solve some of the Engineering applications

TOTAL : 45

HARDWARE/SOFTWARE REQUIRED FOR BATCH OF 30 STUDENTS

HARDWARE

LAN system with 33 nodes (OR) Standalone PCs - 33 Nos

Printers - 3 Nos

SOFTWARE

OS - Windows / UNIX

Application package - MS office

Software - C language

GE 2131 ENGINEERING PRACTICE LABORATORY - I
(Common to all branches)

L	T	P	C
0	0	3	2

GOAL

To provide the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

OBJECTIVES

The course should enable the students to

1. Relate theory and practice of basic Civil and Mechanical Engineering
2. Learn concepts of welding and machining practice
3. Learn concepts of plumbing and carpentry practice

OUTCOMES

The students should be able to

1. Indentify and use of tools, Types of joints used in welding, carpentry and plumbing operations.
2. Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.
3. Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.

LIST OF EXPERIMENTS

I. MECHANICAL ENGINEERING PRACTICE **15**

1. Welding

   Arc welding: Butt joints, Tee and lap joints.

2. Basic Machining

   Facing, turning, threading and drilling practices using lathe and drilling operation with vertical drilling machine.

3. Machine assembly practice

   Study of centrifugal pump

4. Study on

a. Smithy operations - Productions of hexagonal headed bolt.

b. Foundry operations - Mould preparation for gear and step cone pulley.

II. CIVIL ENGINEERING **12**

1. Basic pipe connection using valves, couplings, unions, reducers, elbows in household fitting.

2. Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.
3. Wood work: Sawing, Planning and making common joints.
4. Study of joints in door panels, wooden furniture.

TOTAL : 45

List of equipment and components

(For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes,plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools:
   (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer,wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and otherwelding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

EL 2131 COMMUNICATION SKILLS LABORATORY 1

L	T	P	C
0	0	3	2

GOAL

The goal of the programme is to provide a practical input towards nurturing accomplished learners who can function effectively in the English language skills.

OBJECTIVES

The course should enable the students to

1. Extend the ability of the learners to be able to listen to English and comprehend its message.
2. Enable the learners to have a functional knowledge of spoken English.
3. Assist the learners to read and grasp the meaning of technical and non-technical passages in English.
4. Help the learners develop the art of writing without mistakes.
5. Expand the thinking capability of the learners so that they would learn how to view things from a different angle.

OUTCOME

The students should be able to

1. Listen to and evaluate English without difficulty and comprehend its message.
2. Develope a functional knowledge of spoken English so as to use it in the institution and at job interviews.
3. Read and comprehend the meaning of technical and non-technical passages in English.
4. Develope the art of writing so as to put down their thoughts and feelings in words.
5. Think independently and contribute creative ideas.

UNIT I LISTENING SKILL

Listening to conversations and interviews of famous personalities in various fields -- Listening practice related to the TV-- Talk shows - News - Educative programmes -- Watching films for critical comments - Listening for specific information - Listening for summarizing information - Listening to monologues for taking notes - Listening to answer multiple-choice questions.

UNIT II SPEAKING SKILL

Self-introduction -- Group discussion - Persuading and negotiating strategies - Practice in dialogues -- Presentations based on short stories / poems -- Speaking on personal thoughts and feelings -- academic topics - News reading - Acting as a compere -- Speaking about case studies on problems and solutions - Extempore speeches.

UNIT III READING SKILL

Reading anecdotes to predict the content - Reading for interpretation -- Suggested reading -- Short stories and poems -- Critical reading - Reading for information transfer - Reading newspaper and magazine articles for critical commentary - Reading brochures, advertisements, pamphlets for improved presentation.

UNIT IV WRITING SKILL

At the beginning of the semester, the students will be informed of a mini dissertation of 1000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

UNIT V THINKING SKILL

Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms and proverbs - Inculcating interest in English using thinking blocks. Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading

REFERENCES

1. Raman, Meenakshi, and Sangeetha Sharma. Technical Communication: English Skills for Engineers. 2nd edition. New Delhi: Oxford University Press, 2010.
2. Riordian, Daniel. Technical Communication. New Delhi. Cengage Learning, 2009

Websites for learning English

1. British: Learn English - British Council (Listen & Watch) - <http://learnenglish. british council. org/>
2. American: Randall's ESL Cyber Listening Lab - <http://www.esl-lab.com/>
3. Intercultural: English Listening Lesson Library Online http://www.elllo.org/

Equipments required

1. Career Lab:1 room
2. 2 Computers as a Server for Labs (with High Configuration)
3. LCD Projectors - 4 Nos
4. Headphones with Mic (i-ball) - 100 Nos
5. Speakers with Amplifiers, Wireless Mic and Collar Mic - 2 Sets
6. Teacher table, Teacher Chair - 1 + 1
7. Plastic Chairs - 75 Nos

PH 2031 PHYSICS LABORATORY
(COMMON TO ALL BRANCHES)

L	T	P	C
1	0	3	3

OBJECTIVE

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Physics

OUTCOME

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods

S.No.	List of Experiments	Batch 2 (30)			Batch 1 (30)		
		Week	Periods allotted		Week	Periods allotted	
			L	P		L	P
1	Torsional Pendulum - Determination of rigidity modulus of the material of a wire.	1	1	3	2	1	3
2	Non Uniform Bending - Determination of Young's Modulus.	3	1	3	4	1	3
3	Viscosity -Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.	5	1	3	6	1	3
4	Lee's Disc - Determination of thermal conductivity of a bad conductor.	7	1	3	8	1	3
5	Air Wedge - Determination of thickness of a thin wire.	9	1	3	10	1	3
6	Spectrometer - Refractive index of a prism.	11	1	3	12	1	3
7	Semiconductor laser - Determination of wavelength of Laser using Grating.	13	1	3	14	1	3
	TOTAL	**7**	**2**	**1**	**7**	**2**	**1**
							56 Periods

LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

1	Torsional Pendulum	(500 gm, wt, 60 cm wire Al-Ni Alloy)	5 nos.
2	Travelling Microscope	(X10)	15 nos.
3	Capillary tube	(length 10cm, dia 0.05mm)	5 nos.
4	Magnifying lens	(X 10)	15 nos.
5	Lee's disc apparatus	(std form)	5 nos.
6	Stop watch	(+/- 1 s)	5 nos.
7	Meter scale	1m length	5 nos.
8	Spectrometer	(main scale 360 deg, ver 30")	5 nos.
9	Grating	(2500 LPI)	5 nos.
10	Laser	(632.8 nm)	5 nos.
11	Semi transparent glass plate Al coating, 65 nm thickness,	50% visibility	5 nos.
12	Equilateral prism	(n = 1.54)	5 nos.
13	Thermometer	+/- 1 deg	8 nos.
14	Screw gauge	(+/- 0.001cm)	12 nos.
15	Vernier caliper	(+/- 0.01 cm)	8 nos.
16	Steam Boiler	1 L	5 nos.
17	Scale	50 cms	5 nos.
18	Cylindrical mass	100 gms	10 sets
19	Slotted wt	300 gms	5 sets
20	Heater	1.5 KW	5 nos.
21	Transformer sodium vapour lamp	1 KW	10 nos.
22	Sodium vapour lamp	700 W	5 nos
23	Burette	50 mL	5 nos
24	Beaker	250 mL	5 nos
25	Spirit level		10 nos

REFERENCE

- P.Mani, Engineering Physics Practicals, Dhanam Publications, Chennai, 2005.

CY 2031 CHEMISTRY LABORATORY

L	T	P	C
1	0	3	3

OBJECTIVE

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Chemistry.

OUTCOME

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods

S.No.	List of Experiments (Any Five)	Batch 2 (30)			Batch 1 (30)		
		Week	Periods allotted		Week	Periods allotted	
			L	P		L	P
1	Estimation of Commercial soda by acid-base titration	1	1	3	2	1	3
2	Determination of Percentage of nickel in an alloy	3		3	4		3
3	Determination of Temporary, permanent and total hardness of water by EDTA method	5	1	3	6	1	3
4	Determination of Chloride content in a water sample	7		3	8		3
5	Potentiometric Estimation of iron	9	1	3	10	1	3
6	Conductometric Titration of a strong acid with a strong base	11	1	3	12	1	3
7	Conductometric Titration of mixture of acids.	13	1	3	14	1	3
8	Determination of Degree of polymerization of a polymer by Viscometry	15	1	3	16	1	3
	TOTAL		**6**	**24**		**6**	**24**
							60 Periods

List of Glassware and Equipments required for a batch of 30 students

1	Burette	(50 mL)	30 nos.
2	Pipette	(20 mL)	30 nos.
3	Conical Flask	(250 mL)	30 nos.
4	Distilled water bottle	(1 L)	30 nos.
5	Standard flask	(100 mL)	30 nos.
6	Funnel	(small)	30 nos.
7	Glass rod	20 cm length	30 nos.
8	Reagent Bottle	(250 mL)	30 nos.
9	Reagent Bottle	(60 mL)	30 nos.
10	Beaker	(100 mL)	30 nos.
11	Oswald Viscometer	Glass	30 nos.
12	Measuring Cylinder	(25 mL)	30 nos.
13	Digital Conductivity Meter	PICO make	8 nos.
14	Conductivity cell	(K=1)	12 nos.
15	Digital Potentiometer	PICO make	8 nos.
16	Calomel Electrode	Glass	12 nos.
17	Platinum Electrode	Polypropylene	12 nos.
18	Burette Stands	Wooden	30 nos.
19	Pipette stands	Wooden	30 nos.
20	Retard stands	Metal	30 nos.
21	Porcelain Tiles	White	30 nos.
22	Clamps with Boss heads	Metal	30 nos.

REFERENCES

1. J.Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantative Chemical Analysis, 6th Edition, Pearson Education, 2004.
2. C. W. Garland, J. W. Nibler, D. P. Shoemaker, ;"Experiments in Physical Chemistry", 8th ed., McGraw-Hill, New York, 2009.
3. S. Sumathi, Engineering Chemistry Practicals, Dhanam Publications, 2011.

SEMESTER-II

MA 2201 ENGINEERING MATHEMATICS II

L	T	P	C
3	1	0	4

GOAL

To create the awareness and comprehensive knowledge in engineering mathematics.

OBJECTIVES

The course should enable the students to:

1) Understand the evaluation of the double and triple integrals in Cartesian and polar forms.
2) Know the basics of Vector calculus.
3) Know Cauchy - Riemann equations, Milne - Thomson method and Conformal mapping
4) Grasp the concept of Cauchy's integral formula, Cauchy's residue theorem and contour integration.
5) Know Laplace transform and inverse Laplace transform and their properties.

OUTCOME

The students should be able to:

1) Find area as double integrals and volume as triple integrals in engineering applications.
2) Evaluate the gradient, divergence, curl, line, surface and volume integrals along with the verification of classical theorems involving them.
3) Applies analytic functions and their interesting properties in science and engineering.
4) Evaluate the basics of complex integration and the concept of contour integration which is important for evaluation of certain integrals encountered in practice.
5) Have a sound knowledge of Laplace transform and its properties and their applications in solving initial and boundary value problems.

UNIT I MULTIPLE INTEGRALS **12**

Review: Basic concepts of integration - Standard results - Substitution methods - Integration by parts - Simple problems.

Double integrals: Cartesian and polar co-ordinates - Change of variables - simple problems - Area as a double integral. Triple integrals: Cartesian co ordinates - Volume as a triple integral - simple problems.

UNIT II VECTOR CALCULUS **12**

Review: Definition - vector, scalar - basic concepts of vector algebra - dot and cross products-properties.

Gradient, Divergence and Curl - Unit normal vector, Directional derivative - angle between surfaces- Irrotational and solenoidal vector fields. Verification and evaluation of Green's theorem - Gauss divergence theorem and Stoke's theorem. Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds.

UNIT III ANALYTIC FUNCTIONS **12**

Review: Basic results in complex numbers - Cartesian and polar forms - Demoivre's theorem.

Functions of a complex variable - Analytic function - Necessary and sufficient conditions (without proof) - Cauchy - Riemann equations - Properties of analytic function - Harmonic function - Harmonic conjugate - Construction of Analytic functions by Milne - Thomson method. Conformal mapping: w = z + a, az, 1/z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION **12**

Statement and application of Cauchy's integral theorem and Integral formula - Evaluation of integrals using the above theorems - Taylor and Laurent series expansions -Singularities - Classification. Residues - Cauchy's residue theorem (without proof) - Contour integration over unit circle and semicircular contours (excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM **12**

Laplace transform - Conditions of existence - Transform of elementary functions - properties - Transforms of derivatives and integrals - Derivatives and integrals of transforms - Initial and final value theorems - Transforms of unit step function and impulse function - Transform of periodic functions. Inverse Laplace transform - Convolution theorem - Solution of linear ODE of second order with constant coefficients.

TOTAL: 60

Note: Questions need not be asked from review part.

TEXT BOOKS

1. Venkatraman M.K, Mathematics, Volume - II, National Publishing Company, Chennai, 1985.
2. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.
3. Chandrasekaran A, Engineering Mathematics, Volume - II, Dhanam Publication, 2008.

REFERENCES

1. Kandasamy P, Engineering Mathematics Volume II, S. Chand & Co., New Delhi, 1987.
2. Grewal B.S, Engineering Maths - II, Sultan Chand, New Delhi, 1993.
3. Bali N.P, Manish Goyal, Text book of Engineering Mathematics, 3rd Edition, Lakshmi Publications, 2003.

ME 2201 ENGINEERING MECHANICS

L	T	P	C
3	1	0	4

GOAL

To provide an understanding of the effects of forces, torques and motion on a variety of structures and vehicles.

OBJECTIVES

The course should enable the students to

1. Impart knowledge on the vector and scalar representation of forces and moments
2. Impart knowledge on static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions.
3. Understand the principle of work and energy.
4. Comprehend on the effect of friction on equilibrium, the laws of motion, the kinematics of motion and the interrelationship.
5. Write the dynamic equilibrium equation.

All these should be achieved both conceptually and through solved examples.

OUTCOME

The students should be able to

1. Apply the law of forces and Newton's 2nd law in determining motion and

   The dynamics of particles and vehicles
2. Implement vectors in mechanics problems and Know about Energy and momentum conservation
3. Know the dynamics of a rigid body and its rotation and Do the calculation and motion of the centre of mass of a system of particles
4. Use vectors to solve mechanics problems and Develop particle and vehicle trajectory equations
5. Calculate the motion of rigid bodies and Solving problems on engineering mechanics that arise on other modules of the course.

UNIT I BASICS & STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem, Parallelogram and triangular Law of forces - Vectors - Vectorial representation of forces and moments - Vector operations : addition, subtraction, dot product, cross product - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram - Types of supports and their reactions - Requirements of stable equilibrium - Static determinacy - Moments and Couples - Moment of a force about a point and about an axis -

Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions - Examples.

UNIT III FRICTION **12**

Frictional force - Laws of Coulomb friction - Simple contact friction - Belt friction - Transmission of power through belts - Wedge Friction - Screw Jack - Rolling resistance.

UNIT IV PROPERTIES OF SURFACES AND SOLIDS **12**

Determination of Areas and Volumes - Determination of first moment of area Centroid of sections, Second and product moments of plane area - Rectangle, circle, triangle, T section, I section, Angle section, Hollow section- Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia -Product moment of inertia.

UNIT V DYNAMICS OF PARTICLES **12**

Displacements, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

TOTAL : 60

TEXT BOOKS

1. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and vol. 2 Dynamics, McGraw-Hill International Edition, 1997.
2. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2003.
3. Bedford and N. Fowler, Engineering Mechanics-Dynamics, Adison-Wesley

REFERENCES

1. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
2. Ashok Gupta, Interactive Engineering Mechanics - Statics - A Virtual Tutor (CDROM),

   Pearson Education Asia Pvt., Ltd., 2002.Hill, 2001.
4. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson Education Asia Pvt., Ltd., 2003.

ME 2202 MANUFACTURING TECHNOLOGY-I

L	T	P	C
3	0	0	3

GOAL

To introduce basic manufacturing processes and to develop theoretical skill of students.

OBJECTIVES

The course should enable the students to

1. Learn Metal joining processes
2. Learn Casting processes.
3. Learn Metal forming/high energy rate forming.
4. Learn the processing of plastics

OUTCOME

The students should be able to

1. Understand the various manufacturing methods employed in the Industry.
2. Get knowledge in Basic welding & finishing operations
3. Get knowledge in Hot & cold working of metals including High Energy Rate forming
4. Get knowledge in Plastic manufacturing.

UNIT I METAL CASTING PROCESSES **10**

Sand casting - Sand moulds - Type of patterns - Pattern materials - Pattern allowances- Types of Moulding sand - Properties - Core making - Methods of Sand testing - Moulding machines - Types of moulding machines - Melting furnaces - Working principle of Special casting processes - Shell, investment casting - Ceramic mould - Lost Wax process - Pressure die casting - Centrifugal casting - CO2 process - Sand Casting defects - Inspection methods.

UNIT II FABRICATION PROCESS **10**

Fusion welding processes - Types of Gas welding - Equipments used - Flame characteristics - Filler and Flux materials - Arc welding equipments - Electrodes - Coating and specifications - Principles of Resistance welding - Spot/butt, seam welding - Percusion welding - Gas metal arc welding - Flux cored - Submerged arc welding - Electro slag welding - TIG welding - Principle and application of special welding processes - Plasma arc welding - Thermit welding - Electron beam welding - Friction welding - Diffusion welding - Flame cutting - Weld defects - Brazing and soldering process - Methods and process capabilities - Filler materials and fluxes - Types of Adhesive bonding

UNIT III BULK DEFORMATION PROCESSES **10**

Hot working and cold working of metals - Forging processes - Open and close die forging - Characteristics of the process - Types of Forging Machines - Typical forging operations - Rolling of metals - Flat strip rolling - Types of Rolling mills - Shape rolling operations - Tube piercing - Defects

in rolled parts - Principles of Extrusion - Types of Extrusion - Hot and Cold extrusion -Principle of rod and wire drawing - Equipments used

UNIT IV SHEET METAL FORMING PROCESSES **8**

Sheet metal characteristics - Typical shearing operations, bending and drawing operations - Stretch forming operations - Formability of sheet metal - Test methods - Working principle and application of special forming processes - Hydro forming - Rubber pad forming - Metal spinning - Explosive forming - Magnetic pulse forming - Peen forming - Super plastic forming - Process characteristics

UNIT V FORMING AND SHAPING OF PLASTICS **7**

Types of plastics - Characteristics of forming and shaping processes - Moulding of Thermoplastics - Working principles and typical applications of - Injection moulding - Plunger and screw machines - Blow moulding - Rotational moulding - Film blowing - Extrusion - Typical industrial applications - Thermoforming - Processing of Thermosets - Working principles and typical applications - Compression moulding - Transfer moulding - Bonding of Thermoplastics - Fusion and solvent methods - Induction and Ultrasonic methods.

TOTAL : 45

TEXT BOOKS

1. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promotors Pvt Ltd., Mumbai, 2007
2. Serope Kalpak jain, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 4th Edition, 2009.

REFERENCES

1. Elements of Manufacturing Processes, B.S. Magendran Parashar & R.K. Mittal, Prentice Hall of India, 2008.
2. Manufacturing Technology, P.N. Rao, Tata McGraw-Hill Publishing Limited, 2010.
3. A text book of production technology, P.C. Sharma, S. Chand and Company, 2010.
4. Manufacturing Process - Begman, John Wilely & Sons, VIII Edition, 1999.

EE 2212 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	1	0	4

GOAL

To understand basic principles underlying the behaviour of electrical circuits, electric power apparatus and measurement techniques.

OBJECTIVE

The course should enable the students to

1. Expose the students to the fundamental of electrical circuits, principles of operation of D.C. & A.C. machines, measurements and measuring instruments.

OUTCOME

The students should be able to

1. Understand the basic principles of electric circuits.
2. Know the construction details of electric machines.
3. Know the technique of measurement using voltmeter and ammeter.

UNIT I FUNDAMENTALS OF D.C. AND A.C. CIRCUITS 12

D.C. voltage - current and power - ohm's law - Resistance in series and parallel circuits - current and voltage division - Kirchoff's laws - simple problems using mesh analysis - sinusoidal voltage - R.M.S, average and peak values - phase and phase difference - phasor representation - power factor - voltage and current relation in single phase RC, RL and RLC simple series and parallel circuits - complex power - real, reactive and apparent power - three phase circuits - line and phase values of voltage / current - power measurement in three phase circuits using two wattmeters - simple problems.

UNIT II D.C. AND A.C. MACHINES 12

Constructional details and operating principles of D.C. generators - e.m.f equation - type of generators - O.C.C. and load characteristics - principle and operation of D.C. motors - back e.m.f. - types of motors - speed and torque equation - load characteristics of D.C. motors - starting methods. Construction and operation of synchronous generators - types of synchronous machines - e.m.f equation - load characteristics - principle of operation of synchronous motors - starting methods - simple problems.

UNIT III TRANSFORMERS 12

Constructional details and operation of single phase transformers - types of transformers - e.m.f equation - transformation ratio - transformer on no load and load - parameters of transformers referred to primary and secondary - equivalent circuits - regulation - losses and efficiency - simple problems in single phase transformers - introduction to three phase transformers - types of three phase connections.

UNIT IV INDUCTION MACHINES **12**

Constructional details and principle of operation of three phase induction motor - types of three phase induction motors - e.m.f equation - rotor e.m.f and current at standstill and running conditions - slip - torque characteristics - starting of induction motors- rotor resistance, auto transformer and star - delta starters - losses and efficiency - simple problems. Construction and principle of operation of single-phase induction motors - starting methods - split phase and shaded pole types.

UNIT V MEASUREMENTS AND MEASURING INSTRUMENTS **12**

Deflecting torque, controlling torque and damping torque in indicating instruments - construction and operating principles of moving coil and moving iron instruments - voltmeters and ammeters - construction and operating principles of induction type energy meters and dynamo meter type wattmeters - types of errors.

TOTAL : 60

TEXT BOOKS

1. D.P.Kothari and I.J.Nagrath, 'Basic Electrical Engineering', Second Edition 2002, Tata McGraw-Hill Publishing Company Limited.
2. H. Cotton, Advanced Electrical technology, CBS Publishers, New Delhi,1999.
3. V.K. Metha and Rohit Metha, "Principles of Electrical Engineering", 2003, S.Chand and Company Ltd., New Delhi 110055.

REFERENCES

1. Stephen J.Chapman, Electric Machinery Fundamentals, Third Edition, 1999, McGraw-Hill.
2. S. Parkar Smith, Problems in Electrical Engineering, Asia Publications.
3. K.Murugesh Kumar, Basic Electrical Science & Technology, First Published 2002, Vikas Publishing House Private Limited.
4. T.Thyagarajan, K.P.Sendur Chelvi and T.R.Rangaswamy, Engineering Basics, Third Edition, 2002, New Age International (P) Limited, Publisher

GE 2231 ENGINEERING PRACTICES LABORATORY II

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

S.No	LIST OF EXPERIMENTS	HOURS
	Electrical Engineering:	
1.	Wiring for a tube light.	6
2.	Wiring for a lamp and fan.	6
3.	Staircase wiring	3
4.	Study of (i) Iron box and (ii) Fan with Regulator	6
	Electronics Engineering	
5.	Study of Electronic components and Equipments	3
6.	Characteristics of PN junction diode & measurement of Ripple factor of half wave and full wave rectifier.	9
7.	Applications of OP-AMP - Inverter, Adder and Subtractor.	9
8.	Study and verification of Logic Gates	3

PRACTICAL 45

Components Required:

Electrical Engineering	
Choke	2 nos
Starter	2 nos
Tubelight stand	2 nos
36W tubelight	2 nos
Fan	2nos
40W lamp	5nos
Single way switch	10 nos
Two way switch	5 nos
Iron box	2nos
Fan with regulator opened	1no (demo purpose)
Wires	

Electronics Engineering

IC Trainer Kit, Resistors, Capacitors, CRO, Function Generator,BreadBoard,Regulated Power Supply, Zener Diode, PN Junction Diode, Potentiometer, Digital Multimeter,Ammeter, Voltmeter, Wattmeter, IC 7408,IC 7432,IC 7486, IC 7400, IC 7404, IC 7402

TEXT BOOK

1. T. Jeyapoovan, M.Saravanapandian and S. Pranitha, Engineering Practices Lab Manual, 3rd Edition 2006, Vikas Publishing house (P) Ltd., New Delhi.

EE 2235 ELECTRICAL ENGINEERING LAB

L	T	P	C
0	0	3	2

GOAL

To Impart hands-on training to the students on various types of motors and controls

OBJECTIVES

The course should enable the students to

1. Impart knowledge on DC Motors and its load characteristics
2. Impart knowledge on Single phase transformers
3. Impart knowledge on AC Motors and its load characteristics
4. Impart knowledge on DC & AC Starters

LIST OF EXPERIMENTS

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters

TOTAL : 45

LIST OF EQUIPMENTS (for batch of 30 students)

1.	DC Shunt motor	- 2 No
2.	DC Series motor	- 1 No
3.	DC shunt motor-DC Shunt Generator set	- 1 No
4.	DC Shunt motor-DC Series Generator set	- 1 No
5.	Single phase transformer	- 2 No
6.	Three phase alternator	- 2 No
7.	Three phase synchronous motor	- 1 No
8.	Three phase Squirrel cage Induction motor	- 1 No
9.	Three phase Slip ring Induction motor	- 1 No
10.	Single phase Induction motor	- 1 No

EL2231 COMMUNICATION SKILLS LABORATORY - II

L	T	P	C
2	0	2	3

PREREQUISITE E L2101

GOAL

The goal of the programme is to provide an advanced practical input towards moulding student-achievers who can use the English language with ease.

OBJECTIVES

The course should enable the students to:

1. Extend the power of the learners to listen to English at an advanced level and comment on it.
2. Guide the learners to speak English at the formal and informal levels.
3. Enable learners to read and grasp the in-depth meaning of technical and non-technical passages in English.
4. Help the learners develop the art of writing at the formal and informal levels.
5. Expand the thinking capability of the learners so that they would learn how to be original in their thoughts.

OUTCOME

At the end of the course the student should be able to:

1. Listen to and understand English at an advanced level and interpret its meaning.
2. Develop English at the formal and informal levels and thus gained the confidence to use it without fear.

3. Read and grasp the in-depth meaning of technical and non-technical passages in English.

4. Develop the art of formal and informal writing.

5. Think independently and creatively and also verbalize their thoughts fearlessly.

UNIT I LISTENING SKILL **9**

Topics: Listening to telephonic conversations -- Listening to native British speakers -- Listening to native American speakers -- Listening to intercultural communication -- Listening to answer questions as one-liners and paragraphs -- Listening practice to identify ideas, situations and people -- Listening to group discussions -- Listening to films of short duration.

UNIT II SPEAKING SKILL **9**

Topics: Interview skills - People skills - Job interview - Body language and communication -- How to develop fluency -- Public speaking -- Speaking exercises involving the use of stress and intonation - Speaking on academic topics - Brain storming & discussion - Speaking about case studies on problems and solutions - Extempore speeches - Debating for and against an issue - Mini presentations - Generating talks and discussions based on audiovisual aids.

UNIT III READING SKILL **9**

Topics: Reading exercises for grammatical accuracy and correction of errors -- Reading comprehension exercises with critical and analytical questions based on context - Evaluation of contexts - Reading of memos, letters, notices and minutes for reading editing and proof reading -- Extensive reading of parts of relevant novels after giving the gist of the same.

UNIT IV WRITING SKILL **9**

Topics: At the beginning of the semester, the students will be informed of a mini dissertation of 2000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

UNIT V THINKING SKILL **9**

Topics: Practice in preparing thinking blocks to decode pictorial representations into English words, expressions, idioms and proverbs - Eliciting the knowledge of English using thinking blocks -- Picture rereading -- Finding meaning in the meaningless - Interpreting landscapes, simple modern art and verbal and non-verbal communication.

TOTAL : 45

REFERENCES

1. Ibbotson, Mark. Cambridge English for Engineering. New Delhi: Cambridge University Press, 2009.

2. Smith-Worthington Jefferson. Technical Writing for Success. New Delhi. Cengage Learning, 2007.

WEBSITES FOR LEARNING ENGLISH

1. British: Learn English - British Council (Business English) - <http://learnenglish. british council. org/>
2. BBC Learning English (General and Business English) - <http://www.bbc.co.uk/worldservice/learningenglish/>
3. Intercultural: English Listening Lesson Library Online http://www.elllo.org/

Equipments required

1. Career Lab:1 room
2. 2 Computers as a Server for Labs (with High Configuration)
3. LCD Projectors - 4 Nos
4. Headphones with Mic (i-ball) - 100 Nos
5. Speakers with Amplifiers, Wireless Mic and Collar Mic - 2 Sets
6. Teacher table, Teacher Chair - 1 + 1
7. Plastic Chairs - 75 Nos

SEMESTER - III

MA 2301 ENGINEERING MATHEMATICS III
(Common to all branches)

L	T	P	C
3	1	0	4

GOAL

To develop the skills of the students in the areas of boundary value problems and transform techniques

OBJECTIVES

The course should enable the students to

1. Develop the skills of the students in the areas of boundary value problems and transform techniques.
2. Gain a knowledge in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory.
3. Serve as a prerequisite for post graduate and specialized studies and research.

OUTCOME

The students should be able to

1. Formulate certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
2. Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
3. Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results
4. Have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair, and specialization on Fourier transform pair, their properties, the possible special cases with attention to their applications.
5. Have learnt the basics of Z - transform in its applicability to discretely varying functions gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 12

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range sine series - Half

range cosine series - Complex form of Fourier Series - Parseval's identify - Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS **12**

Classification of second order linear partial differential equations - Solutions of one dimensional wave equation - One dimensional heat equation - Steady state solution of two-dimensional heat equation (Insulated edges excluded) - Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM **12**

Fourier integral theorem (without proof) - Fourier transform pair - Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem.

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS **12**

Z-transform - Elementary properties - Inverse Z - transform - Convolution theorem -Formation of difference equations - Solution of difference equations using Z - transform.

TOTAL : 60

TEXT BOOK

1. Grewal, B.S., Higher Engineering Mathematics, 39th Edition, Khanna Publishers, Delhi, 2007.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., Engineering Mathematics Volume II", S. Chand & Company ltd., New Delhi, 4th edition 2009.
3. Wylie C. Ray and Barrett Louis, C., Advanced Engineering Mathematics, Sixth Edition, McGraw-Hill, Inc., New York, 1995.

REFERENCES

1. Andrews, L.A., and Shivamoggi B.K., Integral Transforms for Engineers and Applied Mathematicians, Macmillen, New York, 2007.
2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., Advanced Mathematics for Engineering Students, Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
3. Churchill, R.V. and Brown, J.W., Fourier Series and Boundary Value Problems, Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.

ME 2301 ENGINEERING THERMODYNAMICS

L	T	P	C
3	1	0	4

GOAL

To provide an appreciation of energy conversion processes in the context of engineering applications and to introduce the laws of thermodynamics.

OBJECTIVES

The course should enable the students to

1. Understand the energy conversion processes involving heat, work and energy storage.
2. The application of thermodynamic principles to the propulsion of land, sea and air transport and in the generation of power.
3. Analysis various thermal processes and plant.
4. Identify information requirements and sources for analysis and evaluation
5. Synthesize information and ideas for use in the evaluation process.

OUTCOME

The students should be able to

1. Analyze and solve problems in a methodical fashion.
2. Relate the concepts of Energy (Heat & Work) in real life situations and Apply energy transformation in flow & non flow processes.
3. Understand the concepts of degradation of energy and its effect in practical applications
4. Understand the concepts of sensible heat , Latent heat and to understand the fundamentals of ideal and real gases and its properties.
5. Learn laws of ideal and real gases, gas mixtures and their properties.

UNIT I BASIC CONCEPTS **12**

Applications of thermodynamics: Thermodynamic systems, concepts of continuum, some basic definitions, open and closed systems, processes, cycle, Thermodynamic properties, state and equilibrium, Definitions of heat and work, sign conventions, determination of work during different processes, temperature, zeroth law of thermodynamics.

UNIT II FIRST LAW OF THERMODYNAMICS **12**

The First Law for closed systems. Work and heat during cyclic and non-cyclic processes. Specific heats, internal energy and enthalpy for ideal gases.

The First Law for open systems. The steady flow energy equation. Application to boiler, nozzles, throttles, turbines and heat exchangers.

UNIT III SECOND LAW OF THERMODYNAMICS **12**

Definition of the heat engine and cycle efficiency. The Carnot heat engine; Reversed heat engines (heat pump and refrigerator) and coefficient of performance.

Second law of thermodynamics Statements, reversibility, causes of irreversibility, Carnot cycle, reversed Carnot cycles. Thermodynamic Temperature Scale, Clausius inequality, Definition of entropy and its use in engineering thermodynamics. Entropy change in isothermal and adiabatic processes. Isentropic processes.

UNIT IV PROPERTIES OF PURE SUBSTANCE **12**

Thermo dynamic properties of pure substances, property diagram, PVT surface of water and other substances, calculation of properties, first law and second law analysis using tables and charts,

UNIT V IDEAL & REAL GASES AND THERMODYNAMIC RELATIONS **12**

Gas mixtures - Properties of ideal and real gases, equation of state, Avagadro's law, Vander Waal's equation of states, compressibility, compressibility chart. Dalton's law of partial pressure, Exact differentials, T-D relations, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

TOTAL : 60

TEXT BOOKS

1. Cengel & Boles. Thermodynamics: an Engineering Approach, 5th Edition. McGraw Hill. ISBN 0072884959
2. Rogers and Mayhew, Thermodynamic and Transport Properties of Fluids, Basil Blackwell
3. Nag, P.K., Engineering Thermodynamics, 1st Edition, Tata McGraw-Hill Publishing Company Limited New Delhi, 1993.
4. Russel, Engineering Thermodynamics, 1st Edition, Oxford University Press, 2007

REFERENCES

1. Holman J.P, Thermodynamics, 4th Edition, McGraw-Hill Book Company,New York,1888.
2. Rao, Y.V.C., Thermodynamics,4th Edition,Wiley Eastern Ltd.,New Delhi,1993.

ME 2302 FLUID MECHANICS

L	T	P	C
3	1	0	4

GOAL

Provide an understanding of fundamental aspects of the physics of fluid flow, and to develop tools to analyse simple engineering fluids systems.

OBJECTIVES

The course should enable the students to

1. Impart knowledge on the properties of fluid flow and methods of analysis, including conservation's principles for mass, momentum and energy.
2. Generate a framework for advanced courses by introducing and classifying common engineering applications.
3. Impart knowledge on the concepts of laminar and turbulent flow, boundary layers, bluff body and streamlined flow, transition, separation and cavitation.

OUTCOME

The students should be able to

1. Understand important fluid properties and principles in fluid mechanics.
2. Perform straightforward analysis of examples on conservation of mass and momentum.
3. Use dimensional analysis in appropriate ways and explain the physical meaning of various non-dimensional parameters.
4. Assess simple flows and their behaviour from fundamental information such as the value of the Reynolds number and the shape of the body.

UNIT I FLUID STATICS **15**

Fluid - Definition, distinction between solid and fluid - Units and dimensions - Properties of Fluid -- density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - pressure head - Pascal's law - absolute and gauge pressures - measurement of pressure - manometers (single, U-tube, differential), Mechanical gauges - Hydrostatic forces on a submerged plane and curved surfaces - centre of pressure - Buoyancy and Floatation - Meta-centric height - stability of floating and submerged bodies.

UNIT II FLUID KINEMATICS **15**

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration- continuity equation (one and three dimensional differential forms) - Equation of streamline - stream function - velocity potential function - circulation - flownet.

Fluid Dynamics:

Euler's Equation of motion - Bernoulli's Equation - Applications - Venturimeter, orifice meter, pitot tube - free liquid jet - impulse momentum equation - coriolis co-efficients - flow through an orifice - Torricelli's theorem - hydraulic coefficients.

UNIT III INCOMPRESSIBLE FLUID FLOW **15**

Reynold's experiment - critical Reynolds number - Navier - stokes equations of motion (statement only) - relation between shear stress and pressure gradient - flow of viscous fluid in circular pipes - Haigen poiseuille's equation - turbulent flow - Darcy Weisbach equation - major and minor energy losses - pipes in series and parallel - power transmission through pipes.

UNIT IV DIMENSIONAL ANALYSIS **6**

Fundamental and derived units - Dimensional consistency - Dimensionless groups in fluid mechanics: Reynolds number etc. - Buckingham pi theorem with applications to fluid flow and fluid machines - similarity laws and models.

UNIT V BOUNDARY LAYER **9**

Bluff and streamlined bodies - Concept of a boundary layer -. Boundary layer separation - Pressure distribution around cylinders and aerofoils - Lift and drag - Cavitation.

TOTAL : 60

TEXT BOOKS

1. Cengel Y.A. &.Cimbala J.M, Fluid Mechanics: Fundamentals & Applications, 1st Ed (2006) McGraw-Hill. (DVD, including lots of videos and the Engineering Equation Solver (EES), emphasis on SI units, lots of figures, worked examples and set problems).
2. White FM, Fluid Mechanics, 5th Ed (2003) McGraw-Hill (CD containing EES, Imperial & SI units)
3. Massey B, Mechanics of Fluids, 7th Ed (1998) Kluwer. (Exclusively SI units).

REFERENCES

1. Streeter, V.L., and Wylie, E.B., Fluid Mechanics, McGraw-Hill, New Delhi 2010.
2. Bansal,R.K., A Text Book Of Fluid Mechanics and Hydraulic Machine, 9th Edition, Laxmi Publications (P) Ltd.,2005.
3. Roberson, J.A. and Crowe C.T., Engineering Fluid Mechanics, 6th Edition, Johwiley,1999.
4. Bruce,R.M., Donald, F.Y., Theodore, H.O., Fundamentals Of Fluid Mechanics, 5th Edition, John Wiley &Sons (Asia) Pvt. Ltd. India,2002
5. Rajput R K, Fluid Mechanics and Hydraulic Machines, 2nd revised Edition, S.Chand & Company Ltd., New Delhi, 2002

ME 2303 MANUFACTURING TECHNOLOGY-II

L	T	P	C
3	0	0	3

GOAL

To develop knowledge on basic machine tools and machining operations and the underlying concepts to enhance productivity

OBJECTIVES

The course should enable the students to

1. Create awareness of various types of machine tools used in the Industry and their application
2. Understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping milling, drilling grinding broaching
3. Understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.

OUTCOME

The students should be able to

1. Select the cutting tools required for various machining operations;
2. Select the proper machine tools for a particular operation
3. Understand the concepts of CNC and to programme.

UNIT I THEORY OF METAL CUTTING 8

Introduction: material removal processes, types of machine tools - theory of metal cutting: chip formation, orthogonal metal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 10

Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation.

Capstan and turret lathes - automatic lathes: semi automatic, automats - single spindle : cutting off, swiss type, automatic screw type - multi spindle; cutting off, bar type.

UNIT III RECIPROCATING AND MILLING MACHINES 10

Reciprocating machine tools: shaper, planer, slotter; milling : types, milling cutters, operations; hole making : drilling, reaming, boring, tapping.

UNIT IV ABRASIVE PROCESS, SAWING, BROACHING AND GEAR CUTTING 10

Abrasive processes: grinding wheel - specifications and selection, types of grinding process- cylindrical grinding, surface grinding, centreless grinding - honing, lapping, super finishing, polishing and buffing, abrasive jet grinding

Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction-push, pull, surface and continuous broaching machines, gear cutting: forming, generation, shaping, hobbing.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 7

Numerical control (NC) machine tools - CNC: types, constructional details, special features.

Part programming fundamentals - manual programming - computer assisted part programming- APT language.

TOTAL : 45

TEXT BOOKS

1. Rao, P.N. Manufacturing Technology, Metal Cutting and Machine Tools, Tata McGraw-Hill, New Delhi, 2010.
2. Richerd R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, Machine Tool Practices, Prentice Hall of India, 2003.

REFERENCES

1. HMT - Production Technology, Tata McGraw-Hill, 1998.
2. Sharma P.C., A Text Book of Production Engineering, S. Chand and Co. Ltd, 2010.
3. Hajra Choudhary, Elements of Work Shop Technology - Vol. II, Media Promoters. 2002
4. Geofrey Boothroyd, Fundamentals of Metal Machining and Machine Tools, McGrawhill 1984.

ME 2304 METROLOGY & MEASUREMENTS

L	T	P	C
3	0	0	3

GOAL

To understand the principles of metrology and measurements, methods of measurement and its application in manufacturing industries.

OBJECTIVES

The course should enable the students to

1. Focus on issues related to accuracy, selection
2. Learn calibration of measuring Instruments
3. Select and use various measuring instruments used in workshops and other applications.
4. Understand the advanced concepts involved in measuring Technology (measurements)

OUTCOME

The students should be able to

1. Use precision measurement instruments found in a workshop (metrology)
2. Examine the design critically and to understand the use of precision measuring instruments commonly found in various applications.
3. Select the right measuring tool with decided accuracy for a given application
4. Appreciate the importance of accuracy and its effects on results and its uncertainty

UNIT I CONCEPT OF MEASUREMENT **9**

General concept - Generalized measurement system-Units and standards-measuring instruments-sensitivity, readability, range of accuracy, precision-static and dynamic response- repeatability-systematic and random errors-correction, calibration, interchangeability.

UNIT II LINEAR AND ANGULAR MEASUREMENT **9**

Definition of Metrology - Linear measuring instruments: Vernier, Micrometer, internal measurement, Slip gauges and classification, Interferometery, optical flats, limit gauges.

Comparators: Mechanical, pneumatic and electrical types, applications.

Angular measurements:Sine bar,optical bevel protractor,angle Decker - Taper measurements

UNIT III FORM MEASUREMENT **9**

Measurement of screw threads-Thread gauges, floating carriage micrometer-measurement of gear-tooth thickness-constant chord and base tangent method-Gleason gear testing machine - radius measurements-surface finish, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY **9**

Precision instruments based on laser-Principles- Laser Interferometer-application in linear, angular

measurements and machine tool metrology Coordinate measuring machine (CMM)- Constructional features - types, applications - digital devices- computer aided inspection.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE RELATED PROPERTIES **9**

Force, Torque, Power - Mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement:- Venturi, Orifice, Rotameter, Pitot tube. Temperature:- Bimetallic strip, Thermometers, Thermocouples, Electrical resistance Thermister.

TOTAL : 45

TEXT BOOKS

1. Jain R.K., Engineering Metrology, Khanna Publishers, New Delhi.2008.
2. Alan S. Morris, The Essence of Measurement, Prentice Hall of India, 1997

REFERENCES

1. Gupta S.C, Engineering Metrology, Dhanpat rai Publications, 1994.
2. Jayal A.K, Instrumentation and Mechanical Measurements, Galgotia Publications 2000
3. Beckwith T.G, and N. Lewis Buck, Mechanical Measurements, Addison Wesley, 2009.
4. Donald D Eckman, Industrial Instrumentation, Wiley Eastern,New Delhi, 2004.

ME 2331 FLUID MECHANICS LAB

L	T	P	C
0	0	3	2

GOAL

To impart knowledge on the fluid flow concepts and to apply, understand, and validate the concepts of fluid mechanics practically

OBJECTIVES

The course should enable the students to

1. Provide knowledge on calibration Technologies
2. Measure and analyze the flow parameters
3. Understand the concepts of fluid mechanics practically

OUTCOME

The students should be able to

1. Determine co-efficient of discharge
2. Apply Bernoulli equation for fluid flow
3. Impart knowledge on the fluid flow concepts and to validate practically

LIST OF EXPERIMENTS

1. Calibration of Bourdon tube Pressure Gauge.
2. Measurement of velocity with Pitot-Static Tube.
3. Determination of the Coefficient of discharge of given Orifice meter.
4. Determination of the Coefficient of discharge of given Venturi meter.
5. Calculation of the rate of flow using Rota meter.
6. Application of Bernoulli equation for incompressible flow.
7. Determination of friction factor for a given set of pipes.
8. Conducting experiments to find the laminar to turbulent transition for a flow in a pipe.
9. Determination of surface pressure distribution for flow over cylinder and aerofoil.

TOTAL: 45

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Calibration of a Pressure Gauge setup.
2. Orifice meter setup
3. Venturi meter setup
4. Rotameter setup
5. Fluid Friction Apparatus
6. Reynolds Number and Transitional Flow Apparatus.
7. Wind Tunnel

Quantity: one each.

ME 2332 MANUFACTURING TECHNOLOGY LAB

L	T	P	C
0	0	3	2

GOAL

To impart knowledge on Mechanics of metal cutting & Machining Operations

OBJECTIVES

The course should enable the students to

1. Learn the Applications of mechanics of metal cutting
2. Have knowledge on milling and drilling and grinding operations
3. Introduce the CNC Machine.

OUTCOME

The students should be able to

1. Select the right tool, machining condition and relevant measurement
2. Know the methods and applications of various machining operations
3. Understanding the CNC hardware and CNC Programming

EXERCISES

1. Two or More Metal Cutting Experiments (Example: Shear Angle Measurement, Cutting Force Measurement, Cutting Temperature Measurement, Tool Wear Measurement, Life Measurement etc.)
2. One or More Exercises in Milling Machines (Example: Milling Polygon Surfaces, Gear milling, Keyway milling, Helical Groove milling etc.)
3. Two or More Exercises in Grinding / Abrasive machining (Example: Surface Grinding, Cylindrical Grinding, Centreless Grinding, Lapping, Honing etc.)
4. Two or More Exercises in Machining Components for Assembly of different fits. (Example: Machining using Lathes, Shapers, Drilling, Milling, Grinding Machines etc.)
5. One or More Exercises in Capstan or Turret Lathes
6. One or More Exercises in Gear Machining (Example: Gear Cutting, Gear Shaping, Gear Hobbing etc.)
7. One or More Exercises in CNC Machines (Example: CNC Programming, CNC Tooling, CNC Machining etc.)

TOTAL : 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

1.	Centre Lathes	- 15 No (5 Precision Type)
2.	Turret and Capstan Lathe	- 1 No each
3.	Horizontal Milling Machine	- 1 No
4.	Vertical Milling Machine	- 1 No
5.	Surface Grinding Machine	- 1 No
6.	Tool Dynamometer	- 1 No
7.	Gear Hobbing Machine	- 1 No
8.	CNC Lathe (Trainer or Industrial Type)	- 1No

ME2333 METROLOGY & MEASUREMENTS LAB

L	T	P	C
0	0	3	2

GOAL

To impart the knowledge about various measurement techniques

OBJECTIVES

The course should enable the students to

1. Study of calibrations of measuring devices
2. Measurement of form, angle, thread etc.,
3. Measurement of force, Torque, Vibration etc.,

OUTCOME

The students should be able to

1. Understand the Calibration procedures
2. Gain knowledge about form, angle and thread measurement.
3. Know the procedures / Techniques to measures temperature, Torque, Vibration etc.,

LIST OF EXPERIMENTS

1. Calibration of Vernier / Micrometer / Dial Gauge
2. Checking Dimensions of part using slip gauges
3. Measurements of Gear Tooth Dimensions
4. Measurement of Taper Angle using sine bar / Tool Makers microscope
5. Measurement of straightness and flatness
6. Measurement of thread parameters
7. Checking the limits of dimensional tolerances using comparators (Mechanical / Pneumatic / Electrical)
8. Measurement of Temperature using Thermocouple / Pyrometer
9. Measurement of Displacement (Strain Gauge / LVDT / Wheatstone Bridge)
10. Measurement of Force
11. Measurement of Torque
12. Measurement of Vibration / Shock

TOTAL : 45

LIST OF EQUIPMENTS
(for a batch of 30 students)

1.	Micrometer	-	5 No
2.	Vernier Caliper	-	5 No
3.	Vernier Height Gauge	-	2 No
4.	Vernier Depth Gauge	-	2 No
5.	Slip Gauge Set	-	1 No
6.	Gear Tooth Vernier	-	1 No
7.	Sine Bar	-	2 No
8.	Bevel Protractor	-	1 No
9.	Floating Carriage Micrometer	-	1 No
10.	Profile Projector	-	1 No
11.	Mechanical / Electrical / Pneumatic Comparator	-	1 No
12.	Temperature Measuring Setup	-	1 No
13.	Displacement Measuring Setup	-	1 No
14.	Force Measuring Setup	-	1 No
15.	Torque Measuring Setup	-	1 No
16.	Vibration / Shock Measuring Setup	-	1 No

ME 2334 MACHINE ELEMENTS AND ASSEMBLY DRAWING

L	T	P	C
2	0	2	3

GOAL

To make the students to understand and practice Machine Drawing and to expose to Computer Aided Drafting.

OBJECTIVES

The course should enable the students to

1. Understanding limits, Fits and Tolerances.
2. Understanding CAD and AUTOCAD
3. Explaining and Sketching Valves,Cocks and Plugs.
4. Various parts of Machinery.

OUTCOME

The students should be able to

1. Understand the drawing conventions
2. Gain sufficient knowledge on Limits, Fits and Tolerances and their representation in the drawing
3. Have sufficient knowledge in CAD softwares and their use.
4. Draw and read the Machine Drawing used in the Industry.

UNIT I EXPLANATION AND SKETCHING OF THE FOLLOWING ASPECTS 10

Dimensioning conventions of shafts, arcs, angles, holes, tapers, riveted & welded joints, threads and pipes.

Conventional representation of metals and materials. Sectioning Conventions, removed sections and revolved sections, parts not usually sectioned, Conventions of gears, helical, leaf and torsional Springs.

UNIT II LIMITS, FITS AND TOLERANCES 10

Limits and tolerances, Surface Finish, Type of fits - Description, Hole basis System and Shaft basis system, calculations involving minimum and maximum clearances for given combination of tolerance grades- Simple problems, Geometric tolerances

UNIT III CAD DRAWING

Introduction to Computer Aided Drafting. Study of capabilities of software for Drafting and Modeling - Coordinate systems (absolute, relative, polar, etc.) - Creation of simple figures like polygon and general multi-line figures. Drawing of a Title Block with necessary text and projection symbol.

UNIT IV 3D - MODELING 20

Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

UNIT V MACHINERY COMPONENT DRAWING 20

Drawing of complete machine components in assembly (Orthographic to isometric and isometric to Orthographic) with details like couplings, Glands, Return and non-return valves, cocks & plugs, cylinder, Boiler mountings - Full bore safety valve, Blow down cock, Gauge glass, Main stop valve.

TOTAL : 60

TEXT BOOK

1. N.D.Bhatt, Machine Drawing, 18th Edition, Charotar Publication, Mumbai, 2001.

REFERENCES

1. Gopalakrishna K.R., Machine Drawing, 17th Edition, Subhas Stores Books Corner, Bangalore, 2003.
2. Gill P.S., A text book on Machine Drawing, S.K. Kataria & sons, Mumbai, 2000.

3. P.S.G. Design Data Book. 11th Revised edition.2008.

4. Ellen Finkelstein, AutoCAD 2004 Bible, Wiley Publishing Inc, 2003.

5. Sham Tikoo, AutoCAD 2002 with Applications ,Tata McGraw-Hill Publishing Company, New Delhi, 2004.

6. CollabCAD Software, National Informatics Centre (CAD Group), Govt. of India, A-Block, C.G.O. Complex, Lodhi Road, New Delhi 2003, www.collabcad.com.

WEB SITES:

www.autodesk.com, www.ptc.com, www.solidworks.com, www.autodeskpress.com

SEMESTER - IV

MA 2401 NUMERICAL METHODS

L	T	P	C
3	1	0	4

GOAL

To create the awareness and comprehensive knowledge in numerical solutions.

OBJECTIVES

The course should enable the students to:

1) Learn the techniques of solving the algebraic and transcendental equations.
2) Learn to interpolate using Newton's forward and backward difference formulae for equal and unequal intervals
3) Understand the use of numerical differentiation and understands to find the approximate area using numerical integration.
4) Understand solving numerically the initial value problems for ordinary differential equations using single step and multi step method.
5) Learn the methods of solving second order partial differential equations numerically and use it to solve initial and boundary value problems for partial differential equations.

OUTCOME

The students should be able to:

1) Find out the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations by direct and indirect methods.
2) Solve problems where huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
3) Use the numerical differentiation and integration when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
4) Solve engineering problems which are characterized in the form of nonlinear ordinary differential equations, since many physical laws are couched in terms of rate of change of oneindependent variable
5) Solve the initial and boundary value problems related heat flow, both one and two dimensional and vibration problems. Understands the numerical techniques of solving the partial differential equation in engineering applications.

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 12

Linear interpolation methods (method of false position) - Newton's method - Statement of Fixed Point

Theorem - Fixed point iteration: x=g(x) method. Solution of linear algebraic system of equations - Direct methods - Gauss-Jordon method and Crout's method - Iterative method: Gauss-Seidel method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation - equal intervals - Newton's forward and backward difference formulae - problems. Interpolation-unequal intervals - Newton's divided difference formula - Lagrange's and inverse interpolation-problems.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Numerical differentiation - Newton's forward and backward difference - Divided differences and finite differences - Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules. Two and Three point Gaussian quadrature formulae - Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods: Taylor series method - first order-second order and simultaneous - Euler and Modified Euler methods. Fourth orderRunge - Kutta method for solving first and second order equations - Multi-step methods: Milne's and Adam's predictor and corrector methods.

UNIT V INITIAL AND BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference solution of second order ordinary differential equation - classification of partial differential equations - Finite difference solution of two dimensional heat flow equations Laplace and Poisson equations. One dimensional heat equation by explicit and implicit methods - One dimensional wave equation

TOTAL : 60

TEXT BOOKS

1. Kandasamy P, Thilagavathy K, Gunavathy K, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.
2. Chandrasekaran A. and Beena James, "Numerical Methods", Dhanam publications, Chennai, 2011.

REFERENCES

1. Burden R.L, and Faires T.D, "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. Gerald C.F, Wheatley P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
3. Balagurusamy E, "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

EC 2411 ELECTRONICS AND MICROPROCESSOR

L	T	P	C
3	0	0	3

GOAL

To impart familiarity with electronic circuit design principles so that mechanical engineers can design and understand simple circuits and can interact effectively with electronic engineers.

OBJECTIVES

The course should enable the students to

1. Amplifier Theory, Digital Circuits, Logic systems and Gates.
2. Analog and Digital Converters and their applications.
3. Learn about Electronic Instruments
4. Understand the concepts involved in Micro Processors.

OUTCOMES

The students should be able to

1. Demonstrate a good grounding in the subject area of electronics
2. Feel suitably prepared for specialist options involving the use of electronics in future studies and a career as a practicing engineer.
3. Appreciate the methods used in experimentation involving electronic circuits
4. understand the utilization of test and measurement equipment appropriate to this subject

UNIT I OPERATION AMPLIFIER THEORY **9**

Concept of Differential Amplifiers - its use in DP AMPS, Linear OP amp circuits.

UNIT II DIGITAL CIRCUITS **12**

Logic Systems and Gates - Binary and BCD codes - Boolean algebra - Simplifications - Flip - flops - Counters - Registers and multiplexers.

ITL & CMOS GATES:

Digital integrated circuits - Semi conductor memories - ROM - RAM and PROM.

UNIT III ELECTRONIC INSTRUMENTS **10**

Converters; (A-D and D- A): Analog to Digital and Digital to Analog Converters and their use in Data - Loggers.

Electronic instruments: Cathode Ray Oscilloscope - digital voltmeters and frequency meters - Multimeters - Vacuum Tube voltmeter and signal Generators - Q- Meters., Transducers for vibration, pressure, volume, velocity measurement.

UNIT IV INDUSTRIAL ELECTRONICS **8**

Power rectification - silicon control rectifier power control - Photoelectric devices - invertors. Satellite communication as applicable to GMDSS, GPS, Inmarsat.

UNIT V MICROPROCESSORS **6**

8085 Architecture - Programming - interfacing and Control of motors - Temperature/Speed control.

TOTAL : 45

TEXT BOOKS

1. Milman and Halkias, Integrated Electronics, Tata McGraw-Hill publishers, 1995.
2. E. Hughes, Hughes , Electrical and electronic technology, Pearson Educational
3. Horowitz and Hill, The Art of Electronics, CUP.
4. J. Turner, Instrumentation for Engineers, Macmillan.
5. Ramakant.A. Geakwad, Linear integrated circuits, 3rd edition, Prentice - Hall of India, New Delhi, 2001
6. Malvino and Leach, Digital Principles and Applications, Tata McGraw-Hill, 1996

REFERENCES

1. P.S.Bimbhra, Power Electronics, 3rd edition, Khanna Publisher, New Delhi, 2001.
2. Ramesh Gaonkar, Microprocessors and Microcomputers, 4th edition, Ulhasthatak, India, 1999.

ME 2401 THERMAL ENGINEERING

L	T	P	C
3	1	0	4

GOAL

To impart knowledge on how the laws of thermodynamics and basic concepts introduced in the Engineering Thermodynamics course are used in various advanced energy system engineering applications. The course will provide an insight to the applications of engineering thermodynamics and enable the student to solve more advanced problems.

OBJECTIVES

The course should enable the students to

1. Demonstrate the application of the laws of thermodynamics in more advanced and complex systems concentrating on power generation in steam and gas turbine plant.
2. Explain the properties of steam and the use of steam tables.
3. Introduce the properties of steam/air mixtures (psychrometry) and the principles of air conditioning and refrigeration.

OUTCOME

The students should be able to

1. Analyse various thermal processes and plant.
2. Identify information requirements and sources for analysis and evaluation
3. Synthesise information and ideas for use in the evaluation process

UNIT I STEAM AND VAPOUR POWER CYCLES 10

Carnot cycle for steam and ideal efficiency. Rankine cycle with dry, saturated and super heated steam. Modified Rankine, Reheat and Regenerative cycles. Binary vapour power cycles. Feed pump working. Isentropic efficiency, cycle efficiency, work ratio. Reheating and Regenerative feed heating and their effect on thermal efficiency.

UNIT II STEAM NOZZLES 12

General flow analysis. Velocity at the exit. Critical pressure ratio and maximum mass flow. Convergent and convergent-divergent nozzles - Isentropic flow - Effect of Friction. Nozzle area at the throat and exit. Problems on steam flow through nozzles.

Stream Turbine Plants: General principle of Impulse and Reaction Turbines Compounding of steam turbines - Pressure and Velocity compounding, Stage efficiency, Overall efficiency and re-heat factor. Multi-Stage Turbines with regenerative and reheat cycles

UNIT III GAS POWER CYCLES 10

Carnot, Otto, Diesel, Dual cycles, difference between ideal and real cycles; Gas turbine cycles - Brayton cycle; methods of improving performance - inter-cooling, reheat, heat exchangers, cycle configurations and applications.

UNIT IV AIR COMPRESSOR 12

Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressors and inter cooling - working of multistage air compressors, various types of compressors (Descriptive treatment only).

UNIT V PSYCHROMETRY 16

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric processes - Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems

Refrigeration and Air-conditioning: Vapour Compression Refrigeration cycle - super heating, sub cooling, performance calculations. Working principle of vapour absorption system. Ammonia - water, Lithium bromide - water systems (Description only), Comparison between vapour compression and absorption systems. Cooling load calculations. Concept of RSHF, GSHF, ESHF, Air conditioning systems.

TOTAL : 60

TEXT BOOKS

1. Cengel & Boles, Thermodynamics: an Engineering Approach, 4th Edition. McGraw Hill.

I SBN 0072383321.

2. Rogers and Mayhew, Thermodynamic and Transport Properties of Fluids, Basil Blackwell

REFERENCES

1. Rajput, Thermal Engineering, S.Chand publishers, New Delhi 2009.

2. Rudramoorthy R, Thermal Engineering, Tata McGraw-Hill, New Delhi, 2010.

3. Arora.C.P., Refrigeration and Air conditioning, TMH, 2010.

ME 2402 STRENGTH OF MATERIALS

L	T	P	C
3	1	0	4

GOAL

Understand the basic concepts and techniques, both theoretical and experimental, with emphasis on the application of these to the solution of suitable problems in engineering. Provide a firm foundation for more advanced study.

OBJECTIVES

The course should enable the students to

1. Gain knowledge of simple stresses, strains and deformations components due to external loads.
2. Assess stresses and deformations through mathematical models of beams, twisting bars or combination of both.
3. Provide the Basic knowledge for use in the design courses.

OUTCOME

The students should be able to

1. Understand the basic principles of structural elasticity, including statically determinate and indeterminate systems, and the factors which affect their strength and stiffness.
2. Assess the strength and stiffness of simple structural components.
3. Apply the effect of stress and deformation concepts in practical applications.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 12

Rigid and Deformable bodies - Strength, Stiffness and Stability - Stresses; Tensile, Compressive and Shear - Deformation of simple and compound bars under axial load - Thermal stress - Elastic constants - Strain energy and unit strain energy - Strain energy in uniaxial load.

UNIT II BEAMS - LOADS AND STRESSES 12

Types of beams: Supports and Loads - Shear force and Bending Moment in beams - Cantilever,

Simply supported and Overhanging beams - Stresses in beams - Theory of simple bending - Stress variation along the length and in the beam section - Effect of shape of beam section on stress induced - Shear stresses in beams.

UNIT III TORSION **12**

Analysis of torsion of circular bars - Shear stress distribution - Bars of Solid and hollow circular section - Stepped shaft - Twist and torsion stiffness - Compound shafts - Fixed and simply supported shafts - Application to close-coiled helical springs - Maximum shear stress in spring section including Wahl Factor - Deflection of Close-coil helical springs under axial loads - Design of helical coil springs - stresses in helical coil springs under torsion loads

UNIT IV BEAM DEFLECTION **12**

Elastic curve of Neutral axis of the beam under normal loads - Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method -Columns - End conditions - Equivalent length of a column - Euler equation - Slenderness ratio - Rankine formula for columns

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS **12**

Biaxial state of stresses - Thin cylindrical and spherical shells - Deformation in thin cylindrical and spherical shells - Biaxial stresses at a point - Stresses on inclined plane - Principal planes and stresses - Mohr's circle for biaxial stresses - Maximum shear stress - Strain energy in bending and torsion.

TOTAL: 60

TEXT BOOKS

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997.
2. Beer F. P. and Johnston R, "Mechanics of Materials", McGraw-Hill Book Co,Third Edition, 2002.

REFERENCES

1. Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi, 1981
3. Ryder G.H, Strength of Materials, Macmillan India Ltd., Third Edition, 2002
4. Ray Hulse, Keith Sherwin & Jack Cain, Solid Mechanics, Palgrave ANE Books, 2004.
5. Singh D.K, Mechanics of Solids" Pearson Education 2002.

ME 2403 MECHANICS OF MACHINES - I

L	T	P	C
3	1	0	4

GOAL

To provide an understanding of the kinematics and kinetics of simple machine elements and devices.

OBJECTIVES

The course should enable the students to

1. Know the variety of elements employed within a modern complex machine, such as an automobile, together with some historical precedents.
2. Rigid body dynamics (kinematics) of linkages, design of four bar mechanisms,
3. The direct relevance of problems discussed to engineering practice and validation of certain theoretical models through laboratory experiments.

OUTCOME

The students should be able to

1. Understand the existing theory of mechanism, together with its shortcomings, the concepts of mobility, degrees of freedom and inertia and be able to understand how these apply to simple mechanisms and machines;
2. Calculate forces and accelerations in mechanisms
3. Apply typical analytical and graphical techniques, reinforcing and expanding Part I learning, to a variety of mechanical engineering components and systems

UNIT I BASICS OF MECHANISMS **12**

Terminology and Definitions-Degree of Freedom Mobility-Kutzbach criterion-Grashoff's law- Kinematic Inversions of 4-bar chain and slider crank chains-Mechanical Advantage-Transmission angle-Description of common Mechanisms-Single, double and offset slider mechanisms - Quick return mechanisms - Ratchets and escapements - Indexing Mechanisms - Rocking Mechanisms - Straight line generators-Design of Crank-Rocker Mechanisms.

UNIT II KINEMATICS **12**

Displacement, velocity and acceleration - analysis in simple mechanisms - Graphical Method velocity and acceleration polygons - Kinematic analysis by Complex Algebra methods-Vector Approach, Computer applications in the kinematic analysis of simple mechanisms-Coincident points- Coriolis Acceleration.

UNIT III CAMS **12**

Classifications - Displacement diagrams-parabolic, Simple harmonic and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

UNIT IV GEARS **12**

Spur gear Terminology and definitions-Fundamental Law of toothed gearing and involute gearing-Inter changeable gears-gear tooth action - Terminology - Interference and undercutting- Non standard gear teeth- Helical, Bevel, Worm, Rack and Pinion gears (Basics only)-Gear trains- Parallel axis gear trains- Epicyclic gear trains-Differentials

UNIT V FRICTION **12**

Surface contacts-Sliding and Rolling friction - Friction drives - Friction in screw threads - Friction clutches - Belt and rope drives, Friction aspects in Brakes - Friction in vehicle propulsion and braking.

TOTAL : 60

TEXT BOOKS

1. Shingley J.E. & John Joseph Uivker, Jr., Theory of Machines and Mechanisms, 2nd edition, McGraw-Hill International Editions, London, 1981.
2. Ghosh A and A.K.Mallick, Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd., New Delhi, 1988.
3. Rattan S.S, Theory of Machines', Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998.

REFERENCES

1. Rao, J.S., and Dukkipatti, R.V.,Mechanism and machinery theory, 2nd Edition, New age international, Mumbai, 1992.
2. Thomas Bevan, Theory of Machines, CBS Publishers and Distributors, 2002
3. John Hannah and Stephens R.C, Mechanics of Machines, Viva Low-Prices Student Edition, 2005.

EC 2435 ELECTRONICS AND MICROPROCESSOR LAB

L	T	P	C
0	0	3	2

GOAL

To Introduce the Basic electronic components to the Mechanical students

OBJECTIVE

The course should enable the students to

1. Demonstrate the characteristics of Diode, Transistor, Wein Bridge oscillator and logic gates

Outcome

The students should be able to

1. Understand the concepts and working of electronic components and able to appreciate their role in Mechanical Engineering.

LIST OF EXPERIMENTS

ELECTRONICS **30**

1. VI Characteristics of PN Junction Diode
2. VI Characteristics of Zener Diode
3. Characteristics of CE Transistor
4. Characteristics of JFET
5. Characteristics of Uni Junction Transistor
6. RC or Wein Bridge Oscillator
7. Study of Logic Gates (Basic Gates)
8. Half Adder and Full Adder
9. Shift Registers and Counters
10. Operational Amplifier (Adder, Subtractor, Differentiator, Integrator, Inverting and Non - Inverting

MICROPROCESSOR **15**

1. Block Transfer
2. 8 bit Addition, Subtraction
3. Multiplication and Division
4. Maximum and Minimum of block of data
5. Sorting
6. Stepper Motor Interfacing

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Voltmeters - 5 No.
2. Ammeters - 5 No.
3. PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters - 1 set.
4. Digital Logic Trainer Kits - 1 No.
5. Breadboards - 1 No.
6. Microprocessor Kits - 8085 - 5 No.
7. D/A Converter Interface - 1 No.
8. Stepper Motor Interface - 1 No.
9. CRO - 1 No.
10. Wavefarm Generator - 1 No.
11. Multimeter - 1 No.

ME 2431 THERMAL ENGINEERING LAB -I

L	T	P	C
0	0	3	2

GOAL

To gain experimental knowledge on the performance and operations of heat apparatus like compressors and air conditioning plant

OBJECTIVES

The course should enable the students to

1. Understand the basic concepts and utilisation of heat for accomplishing specific work
2. Understand the basic concepts of refrigeration and its COP
3. Learn the basic principle of air conditioning.

OUTCOME

The students should be able to

1. Analyze the flue gases for its various parameters
2. Analyze the performances of air conditioning and refrigeration.
3. Utilize the compressor for different applications

LIST OF EXPERIMENTS

HEAT ENGINES LAB

1. Flue gas analysis by Orsat apparatus.
2. Dryness fraction of steam using calorimeters.
3. Performance characteristics of a constant speed air blower.
4. Verification of fan laws and static efficiency of air blower.
5. C.O.P. of a Refrigeration plant.
6. Performance test on A/C plant.
7. Performance test on single/two stage reciprocating air compressor.

Total: 45

LIST OF EQUIPMENTS (for a batch of 30 students)

1.	Orsat Apparatus	-2 nos
2.	Steam Turbine	-1 no
3.	Steam Calorimeter	-1 no
4.	Air Blower	-1 no
5.	Single/two stage reciprocating air compressor.	- 1 No.

6. Vapour Compression Refrigeration test rig -1 no
7. Vapour compression Air Conditioning test rig -1 no

ME 2432 STRENGTH OF MATERIALS LAB

L	T	P	C
0	0	3	2

GOAL

To understand the properties of materials and metals and how to measure the same

OBJECTIVES

The course should enable the students to

1. Gain knowledge on different metals used in mechanical applications.
2. Understand the importance of strength of different components like springs ,beams etc
3. Understand the heat treatment process which alters the properties of materials.

OUTCOME

The students should be able to

1. Conduct experiments to find out different properties of metals and alloys
2. Compare the properties of metals before and after the heat treatment.

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of

(i) Hardened samples and

(ii) Hardened and tempered samples.

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Universal Tensile Testing machine with double shear attachment - 40 Ton Capacity - 1 No
2. Torsion Testing Machine (60 NM Capacity) - 1 No
3. Impact Testing Machine (300 J Capacity) - 1 No
4. Brinell Hardness Testing Machine - 1 No
5. Rockwell Hardness Testing Machine - 1 No
6. Spring Testing Machine for tensile and compressive loads (2500 N) - 1 No
7. Metallurgical Microscopes - 3 Nos
8. Muffle Furnace (800^0C) - 1 No

ME 2433 PROJECT WORK

L	T	P	C
0	0	6	2

GOAL

To provide practical knowledge on the various components design and manufacturing aspects of a commercially available Mechanical utility.

OBJECTIVE

The course should enable the students to

1. Expose the students to actual design aspects by providing hands on skills.

OUTCOME

The students should be able to

1. Identify various components, materials used, manufacturing process involved and assembly and dismantle of that commercial object.

Exercises:

- To Dismantle and identify the various components, material used, manufacturing process involved and to assemble the following components
- Bicycle / Lathe Components / Gear Box / Two wheeler Engine

Sessional marks will include

- (a) Evaluation of the student's progress,
- (b) Degree of involvement and participation,
- (c) Merit of the project.
- A student will have to defend his project/thesis and credit will be given on the merit of viva-voce examination.

SEMESTER V

ME 2501 DESIGN OF MACHINE ELEMENTS

L	T	P	C
3	1	0	4

GOAL

To expose the students in

1. The various steps involved in the Design Process
2. Understanding the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
3. Learning to use standard practices and standard data learning to use catalogues and standard machine components

OBJECTIVES

The course should enable the students to:

1. Apply engineering analysis principles and methods to the proper analysis of a variety of common mechanical system components.
2. Design these mechanical system components so as to perform safely their intended functions in harmony with other components of the system.
3. Use information resources to identify appropriate and elegant component solutions for mechanical system design problems, locate sources for these components, and understand the analysis and design methods for these components.
4. Confirm with the right codes and standards
5. Work in teams to analyze and design various types of brakes and clutches and present their designs orally and in writing.
6. Identify the characteristics of their designs that have safety and environmental impact.

OUTCOME

The students should be able to:

1. Analyze and design power screws with respect to torque requirements, overhauling, and column buckling.
2. Analyze and design bolted connections with respect to static and dynamic axial loads.
3. Analyze and design bolted riveted, pinned, welded, brazed, soldered, and glued joints with respect to static and dynamic shear and bending loads.
4. Analyze and design full cylindrical hydrodynamic bearings using design charts and custom software.
5. Compute equivalent radial loads for rolling contact bearings and select appropriate bearings for the application using printed and electronic catalogue data.

6. Analyze and design spur gears with respect to tooth bending strength and surface strength specifications and apply three different theories to the design of shafts subject to combined static and dynamic loads.

UNIT I INTRODUCTION TO THE DESIGN PROCESS 12

Factor influencing machine design, selection of materials based on mechanical properties - Direct, Bending and torsion stress equations - Impact and shock loading - calculation of principle stresses for various load combinations, eccentric loading - Design of curved beams - crane hook and 'C' frame - Factor of safety - theories of failure - stress concentration - fatigue strength and the S-N diagram - Soderberg, Goodman and Gerber relations

UNIT II DESIGN OF SHAFTS AND COUPLINGS 12

Design of solid and hollow shafts based on strength, rigidity and critical speed - Design of keys and key ways - Design of rigid and flexible couplings - Introduction to gear and shock absorbing couplings - design of knuckle joints.

UNIT III DESIGN OF FASTENERS AND WELDED JOINTS 12

Threaded fasteners - Design of bolted joints including eccentric loading - Design of welded joints for pressure vessels and structures - theory of bonded joints.

UNIT IV DESIGN OF SPRINGS AND LEVERS 12

Design of helical, leaf, disc and torsion springs under constant loads and varying loads - Concentric torsion springs - Belleville springs - Design of Levers.

UNIT V DESIGN OF BEARINGS AND FLYWHEELS 12

Design of bearings - sliding contact and rolling contact types. - Cubic mean load - Design of journal bearings - McKee's equation - Lubrication in journal bearings - calculation of bearing dimensions - Design of flywheels involving stresses in rim and arm.

TOTAL : 60

Note: (Use of Design Data Book is permitted in the University examination)

TEXT BOOKS

1. Juvinall R.C, and Marshek K.M, Fundamentals of Machine Component Design, John Wiley & Sons, Third Edition, 2002.
2. Bhandari V.B, Design of Machine Elements, Tata McGraw-Hill Book Co, 2003.

REFERENCES

1. Norton R.L, Design of Machinery, Tata McGraw-Hill Book Co, 2004.
2. Orthwein W, Machine Component Design, Jaico Publishing Co, 2003.
3. Ugural A.C, Mechanical Design - An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E Design and Machine Elements Pearson Education, 2004.ect to static and dynamic axial loads.

ME 2502 MECHANICS OF MACHINES - II

L	T	P	C
3	1	0	4

GOAL

To expose the students to understand the Dynamics of machinery principles, Force-motion characteristics and the Undesirable effects of unbalanced motion.

OBJECTIVES

The course should enable the students to:

1. Understand the force-motion relationship in components subjected to External Forces
2. Analyze the force-motion characteristics of standard mechanisms
3. Study the undesirable effects of unbalances resulting from prescribed motions in mechanism.
4. Visualize the effect of Dynamics of Undesirable Vibrations
5. Understand the principles in mechanisms used for governing of Machines.
6. Understand the existing theory of mechanism, together with its shortcomings, the concepts of mobility, degrees of freedom and inertia and be able to understand how these apply to simple mechanisms and machines

OUTCOME

The students should be able to:

1. Understand force analysis of Mechanisms and Balancing.
2. Understand free and Forced Vibration of Single degree of freedom systems.
3. Understanding of rigid body dynamics (kinematics) of linkages, design of four bar mechanisms, gyroscopic devices
4. Calculate forces and accelerations in mechanisms
5. Apply typical analytical and graphical techniques, reinforcing and expanding Part I learning, to a variety of mechanical engineering components and systems
6. Apply the mechanisms in practical applications.

UNIT I FORCE ANALYSIS OF MECHANISMS 12

Static, Inertia and combined force analysis - Graphical and analytical method - Slider crank mechanism and four bar mechanism, turning moment diagram and flywheel - Applications in engine, punching presses.

UNIT II BALANCING 12

Static and dynamic balancing - Balancing of rotating masses - Balancing of several masses in different planes - balancing of rotors, balancing machine, unbalance due to reciprocating parts - balancing of inline engines - Firing order - Balancing of V and W engines - Balancing of radial engines - Lanchester technique of engine balancing.

UNIT III FREE VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS 12

Periodic motion - non harmonic periodic motion - Fourier analysis - undamped free vibration - linear and torsion solution - natural frequency of single degree freedom system - Bifilar, Trifler suspensions - Free vibrations with viscous damping of single degree freedom system and solution - logarithmic decrement.

UNIT IV FORCED VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS 12

Forced vibration of single degree freedom system with damping - reciprocating and rotating unbalance - vibration isolation and transmissibility - base excitation - self excited vibrations with examples.

UNIT V MECHANISMS FOR CONTROL 12

Governors:Types-Centrifugalgovernors-Gravitycontrolledandspringcontrolledcentrifugal governors - Characteristics - Effect of friction - Controlling Force - other Governor mechanisms.

Gyroscopes: GyroscopicforcesandTorques-Gyroscopicstabilization-Gyroscopiceffects inAutomobiles, ships and airplanes

TOTAL : 60

TEXT BOOKS

1. Grover.G.K., Mechanical vibrations, 7th Edition, Nem Chand & Bros, Roorkee, India, 2001.
2. Thomson, W.T. Theory of Vibration with Applications, 3rd Edition, CBS Publishers, New Delhi, 2002.
3. Shingley, J.E. & John Joseph Uivker, Jr., Theory of Machines and Mechanisms, 2nd edition, McGraw - Hill International Editions, London, 1981.
4. Ghosh A. and Malik, A.M. Theory of Mechanisms and machines, 2nd edition, Affiliated East - West Press Pvt. Ltd., New Delhi, 1988

REFERENCES

1. Francis. TSE. Ivan E-Morse Rolland T. Hinkle, Mechanical Vibrations, 2nd edition, CBS Publishers and Distributed, India, 1983.
2. Rao, J.S., and Dukkipatti, R.V., Mechanism and machinery theory, 2nd Edition, New age international, Mumbai, 1992.

ME 2503 GAS DYNAMICS AND JET PROPULSION

L	T	P	C
3	1	0	4

GOAL

A basic understanding of compressible fluid flow and Its importance in industrial Gas Dynamics.

OBJECTIVES

The course should enable the students to:

1. Provide awareness and emphasis on the importance of flow physics that mechanical engineers are likely to encounter in the range of science and industry careers they follow.
2. Understand compressible fluid flow.
3. Learn the computational models of fluid flow
4. Create an awareness of turbulent flow and its significance in industry.

OUTCOME

The students should be able to:

1. Solve simple one-dimensional flow problems by making appropriate assumptions and by applying sensible boundary conditions.
2. Solve simple problems in one-dimensional isentropic and non-isentropic flow.
3. Qualitatively appreciate the complexity of turbulence and the need for computational models for turbulent flow
4. Assess flow contexts, be aware of the types of behavior that may occur, and know where to seek further information to predict behavior.

UNIT I COMPRESSIBLE FLOW - FUNDAMENTALS 12

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.

UNIT II FLOW THROUGH VARIABLE AREA DUCTS 12

Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

UNIT III FLOW THROUGH CONSTANT AREA DUCTS 12

Flow in constant area ducts with friction (Fanno flow) - Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length.

Isothermal flow with friction in constant area ducts

Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.

UNIT IV NORMAL SHOCK **12**

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows, flow with oblique shock (elementary treatment only).

UNIT V JET PROPULSION **12**

Aircraft propulsion, types of jet engines, energy flow through jet engines, study of turbojet engine components-diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbojet engines, thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbojet engine, ram jet and pulse jet engines, Rocket propulsion, rocket engines thrust equation, effective jet velocity specific impulse, rocket engine performance, solid and liquid propellants, comparison of different propulsive systems.

TOTAL : 60

TEXT BOOKS

1. Yahya. S.M., Fundamental of compressible flow, New Age International (p) Ltd., New Delhi, 1996.
2. Patrich.H. Oosthvizen, William E.Carscallen, Compressible fluid flow, McGraw-Hill,1997
3. Rathakrishnan.E, Gas Dynamics, Prentice Hall of India, New Delhi, 2009
4. Y.A.Cengel & J.M.Cimbala, Fluid Mechanics: Fundamentals & Applications, 1st Ed (2006) McGraw-Hill.
5. FM White, Fluid Mechanics, 5th Ed (2003) McGraw-Hill
6. James A. Fay, Introduction to Fluid Mechanics. MIT Press, 1994.

ME 2504 ENGINEERING MATERIALS & METALLURGY

L	T	P	C
3	0	0	3

GOAL

To develop a basic understanding of the properties of materials and hence provide a sound rationale for selection and use of materials in engineering.

OBJECTIVES

The course should enable the students to

1. Impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials.
2. Identify and select suitable materials for various engineering applications.
3. Learn the physical origins of properties of materials and their control.

4. Understand the ways in which properties of materials govern their selection in engineering applications.
5. Show how non-metallic bonding leads to vary different properties (e.g. Ceramics and polymers)

OUTCOME

The students should be able to

1. Demonstrate how defects in atomic structure affect mechanical properties
2. Relate the kinetics of a number of apparently different materials processes to the same underlying process (diffusion)
3. Explain how strengthening mechanisms occur on the microstructural scale and how this is related to the bulk mechanical properties we require in engineering structures
4. Apply the use of phase diagrams to explain the development of microstructure and hence how alloys are designed
5. Analyse failure problems and apply the correct fracture mechanics approach

Review (Not for Exam):

Crystal structure - BCC, FCC and HCP structure - unit cell - crystallographic planes and directions, miller indices - crystal imperfections, point, line, planar and volume defects - Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys - Solid solutions, substitutional and interstitial - phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectroid reactions, Iron - Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

UNIT II HEAT TREATMENT 9

Definition - Full annealing, stress relief, recrystallisation and spheroidizing -normalising, hardening and Tempering of steel. Isothermal transformation diagrams - cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test - Austempering, martempering - case hardening, carburising, nitriding, cyaniding, carbonitriding - Flame and Induction hardening.

UNIT III FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels - HSLA - maraging steels - Gray, White malleable, spheroidal - Graphite - alloy cast irons.

Copper and Copper alloys - Brass, Bronze and Cupronickel - Aluminum and Al-Cu - precipitation strengthening treatment - Bearing alloys.

UNIT IV NON-METALLIC MATERIALS 9

Polymers - types of polymer, commodity and engineering polymers - Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers - Urea and Phenol Formaldehydes - Engineering Ceramics - Properties and applications of Al2O3, SiC, Si3, N4, PSZ and Sialon - Fibre and particulate reinforced composites.

UNIT V MECHANICAL PROPERTIES AND TESTING 9

Mechanism of plastic deformation, slip and twinning - Types of fracture - Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test.

TOTAL: 45

TEXT BOOK

1. Kenneth G.Budinski and Michael K.Budinski , Engineering Materials, Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.
2. William D. Callister, Materials Science and Engineering, an Introduction, (Sixth edition), John Wiley and Sons, 2002

REFERENCE

1. Sydney H.Avner,Introduction to Physical Metallurgy, McGraw Hill Book Company, 1994.

ME 2505 APPLIED HYDRAULICS & PNEUMATICS

L	T	P	C
3	0	0	3

GOAL

To expose the students in Hydraulic and Pneumatic Power Systems, its various components and methods of designing.

OBJECTIVES

The course should enable the students to:

1. Know the advantages and applications of Fluid Power Engineering and Power Transmission Systems.
2. Learn the Applications of Fluid Power System in automation of Machine Tools and others equipments.

OUTCOME

The students should be able to:

1. Understand the advantages of Fluid Power Systems and various components of Fluid Power Systems.
2. Differentiate the merits between the Hydraulic and Pneumatic Power Systems.
3. Design the Fluid Power Systems applicable in automation of Machine Tools and others Equipments.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids - General types of fluids - Fluid power symbols. Basics of Hydraulics-Applications of Pascal's Law- Laminar and Turbulent flow - Reynolds number - Darcy's equation - Losses in pipe, valves and fittings.

UNIT II HYDRAULIC SYSTEM & COMPONENTS 9

Sources of Hydraulic Power: Pumping theory - Pump classification - Gear pump, Vane Pump, Piston pump, construction and working of pumps - pump performance - Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators - Types of hydraulic cylinders - Single acting, Double acting, special cylinders like Tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators - Fluid motors, Gear, Vane and Piston motors.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components : Direction control valve - 3/2 way valve - 4/2 way valve - Shuttle valve - check valve - pressure control valve - pressure reducing valve, sequence valve, Flow control valve - Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers : Types of accumulators - Accumulators circuits, sizing of accumulators, intensifier - Applications of Intensifier - Intensifier circuit.

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air - Compressors - Filter, Regulator, Lubricator Unit - Air control valves, Quick exhaust valves, pneumatic actuators.

Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumatic and Hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems - Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics - Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL : 45

TEXT BOOK

1. Anthony Esposito, Fluid Power with Applications, Pearson Education 2000.
2. Majumdar S.R., Oil Hydraulics, Tata McGraw-Hill, New Delhi 2009.

REFERENCES

1. Majumdar S.R., Pneumatic systems - Principles and maintenance, Tata McGraw Hill, New Delhi 2005.
2. Anthony Lal, Oil hydraulics in the service of industry, Allied publishers, 1982.
3. Harry L. Stevart D.B, Practical guide to fluid power, Taraoeala sons and Port Ltd. Broadey, 1976.
4. Michael J, Prinches and Ashby J. G, Power Hydraulics, Prentice Hall, 1989.
5. Dudelyt, A. Pease and John T. Pippenger, Basic Fluid Power, Prentice Hall.

ME 2506 FLUID MACHINERY

L	T	P	C
3	1	0	4

GOAL

To expose the students in Hydraulic Turbines, Pumps and other Fluid Machinery.

OBJECTIVES

The course should enable the students to:

1. Learn the theory behind the RotoDynamic Machines
2. Understand the details and theory behind Water turbines
3. Learn the details and theory behind centrifugal and reciprocating pumps.

OUTCOME

The students should be able to:

1. Calculate the force exerted by a jet and Understand the theory behind the Rotodynamic Machines.
2. Know about the construction details of Hydraulic Turbines and Pumps.
3. Conduct the experiments on Fluid Machinery and to know about the Cavitation Phenomena and its effect.

UNIT I INTRODUCTION **12**

Classification of fluid machines. Impact of Jets: Force exerted by the jet on a stationary vertical plate - curve plate; Force exerted on moving plates - vertical plate - curved plate; Force exerted by a jet on an unsymmetrical curve plate.

Rotodynamic machines: Basic equation of energy transfer, definition of impulse and reaction machines, principle of similarity and dimensional analysis in rotodynamic machines, concept of specific speed, cavitation.

UNIT II PELTON WHEEL **12**

Description, velocity triangles and analysis of force and power generation in a Pelton wheel, governing of Pelton wheel.

Francis turbine: description, velocity triangles and analysis of force, power and efficiency, net head across Francis turbine, draft tubes.

Kaplan turbines: description. Characteristics of reaction turbines, degree of reaction. Comparison of specific speeds of hydraulic turbines.

UNIT III PUMPS **12**

Classification of pumps. Centrifugal pump, pumping system and net head developed by a pump, manometric efficiency, losses in centrifugal pumps, head-discharge and power-discharge

characteristics of a centrifugal pump. Axial flow pump. Matching of pump and system characteristics, pumps in series and parallel, maximum suction lift, NPSH.

UNIT IV RECIPROCATING MACHINES **12**

Reciprocating pump, slip of reciprocating pump, head-discharge characteristics, rate of delivery, indicator diagram. Multi cylinder pumps. Air vessels. Gear pump, vane pump.

UNIT - V AIR COMPRESSORS **12**

Centrifugal compressor, principle of operation, velocity triangles, stagnation pressure and temperature rise. Axial flow compressor, cascade flow and nomenclature, velocity triangles, degree of reaction, stalling and surging of compressor. Fans and Blowers. Testing and characteristics of Fluid Machinery.

TEXT BOOKS

1. Yahya, S.M., Turbines, Compressors and Fans, Tata McGraw-Hill Publishing Company, 3rd Edition 2009..
2. Dixon S.L Fluid Mechanics, Thermodynamics of turbomachines-2nd Edition, Pergamon press, 6th edition , 2010.
3. R.K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi.
4. Som, S.K., and Biswas, G., Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill, New Delhi,2010.
5. Jagdish Lal, Hydraulic Machines

REFERENCES

1. Kadambi V and Manohar Prasad- An Introduction to energy conversion-Vol.III, Turbomachines-Wiley Eastern India Ltd, 2008..
2. Shepherd D.H. - Principles of Turbomachinery- The Macmillan Company, 1969.

ME 2531 DYNAMICS LAB

L	T	P	C
0	0	3	2

GOAL

To expose the students about the static and dynamic behavior of the machines

OBJECTIVES

The course should enable the students to:

1. Use of various measurement methods
2. Verify the laws governing the dynamics of machines
3. Do the case studies on the field of Vibration

OUTCOME

The students should be able to:

1. Develop the concept of various measurement methods
2. Know about the laws governing the dynamics of machines such as Balancing of Rotating and Reciprocating Mass, Jump phenomenon in Cams, Sensitivity effort in Governors Etc.,
3. Know about different types of vibrations and its applications.

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. M otorised Gyroscope-Verification of laws -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. D etermination of moment of inertia by oscillation method for connecting rod and flywheel.
8. V ibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficients for multidegree freedom suspension system.
10. Determination of transmissibility ratio - vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel system with jumped Moment of inertia.
12. Transverse vibration -free- Beam. Determination of natural frequency and deflection of beam

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Cam analyzer.
2. Motorised gyroscope.
3. Governor apparatus - Watt, Porter, Proell and Hartnell governors.
4. Whirling of shaft apparatus.
5. Dynamic balancing machine.
6. Static and dynamic balancing machine.
7. Vibrating table
8. Vibration test facilities apparatus

ME 2532 FLUID MACHINERY LAB - I

L	T	P	C
0	0	3	2

GOAL

To expose the students in Hydraulic Turbines, Pumps and other Fluid Machinery.

OBJECTIVES

The course should enable the students to:

1. Learn the theory behind the RotoDynamic Machines
2. Know the details and theory behind Water turbines
3. Understand the theory behind centrifugal and reciprocating pumps.

OUTCOME

The students should be able to:

1. Know about the construction details of various Fluid machinery and its working.
2. Know about the Cavitation Phenomena and its effect.
3. Understand the theory behind the Rotodynamic Machines.

LIST OF EXPERIMENTS

1. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump
2. Conducting experiments and drawing the characteristic curves of reciprocating pump.
3. Conducting experiments and drawing the characteristic curves of Gear pump.
4. Conducting experiments and drawing the characteristic curves of Pelton wheel.
5. Conducting experiments and drawing the characteristic curves of Francis turbine.
6. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 45

LIST OF EQUIPMENTS (For a batch of 30 students)

1. Centrifugal pump/submergible pump setup
2. Reciprocating pump setup
3. Gear pump setup
4. Pelton wheel setup
5. Francis turbine setup
6. Kaplan turbine setup

ME 2533 CAM LAB

L	T	P	C
0	0	3	2

GOAL

To expose the students in CNC manual part programming and computer assisted part of programming

OBJECTIVES

The course should enable the students to:

1. Learn the Manual part programming for CNC Lathe & Milling
2. Learn the computer assisted part programming

OUTCOME

The students should be able to:

1. Write the programming for Broaching
2. Design cam software for development CNC code generation

LIST OF EXPERIMENTS

A) COMPUTER AIDED MANUFACTURING (CAM) **36**

1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNC lathe

1.1 Part programming for Linear and Circular interpolation, Chamfering and Grooving

1.2. Part programming using standard canned cycles for Turning, Facing, Taper turning and Thread cutting

2. MANUAL PART PROGRAMMING (using G and M codes) in CNC milling

2.1 Part programming for Linear and Circular interpolation and Contour motions.

2.2 Part programming involving canned cycles for Drilling, Peck drilling, and Boring.

B) SIMULATION AND NC CODE GENERATION 9

NC code generation using CAD / CAM software - Post processing for standard CNC Controls like FANUC, Hiedenhain etc.

TOTAL : 45

LIST OF EQUIPMENT FOR CAM LAB (for a batch of 30 students)

I . HARDWARES

1.	Computer server	-	1 No.
2.	Computer nodes or systems (Pentium IV with 256MB Ram) networked to the server	-	30 Nos.
3.	A 3 size plotter	-	2 Nos.
4.	Laser Printer	-	2 Nos.
5.	Trainer CNC lathe	-	2 Nos.
6.	Trainer CNC milling-Learn computer tra	-	2 Nos.

II. SOFTWARES

1.	CAD/CAM Software (Pro -E or IDEAS or Unigraphics or CATIA)	-	15 licenses
2.	CAM Software (CNC programming and tool path simulation for FANUC, Sinumeric and Heiden controller)	-	15 licenses

SEMESTER - VI

MG 2001 PRINCIPLES OF MANAGEMENT
(common to Auto, Aero and Mech)

L	T	P	C
3	0	0	3

GOAL

To expose the students in managerial functions like planning, organizing, staffing, leading and controlling.

OBJECTIVES

The course should enable the students to:

1. Gain Knowledge on the principles of management is essential at all levels in all types of organizations.
2. Have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling.
3. Students will also gain some basic knowledge on the various functional specialization of management.

OUTCOME

The students should be able to:

1. Understand the organization structure of the industry;
2. Understand the need of Planning;
3. Understand the function of production planning and control, PERT/CPM, Quality Control
4. Do Project Appraisal Analysis
5. Understand the Human resource and marketing management.

UNIT I HISTORICAL DEVELOPMENT **9**

Definition of Management - Science or Art - Management and Administration - Development of Management Thought - Contribution of Taylor and Fayol - Functions of Management - Types of Business Organisation.

UNIT II PLANNING **9**

Nature & Purpose - Steps involved in Planning - Objectives - Setting Objectives - Process of Managing by Objectives - Strategies, Policies & Planning Premises- Forecasting - Decision- making.

UNIT III ORGANISING **9**

Nature and Purpose - Formal and informal organization - Organization Chart - Structure and Process - Departmentation by difference strategies - Line and Staff authority - Benefits and Limitations - De-Centralization and Delegation of Authority - Staffing - Selection Process - Techniques - HRD - Managerial Effectiveness.

UNIT IV DIRECTING **9**

Scope - Human Factors - Creativity and Innovation - Harmonizing Objectives - Leadership - Types of Leadership Motivation - Hierarchy of needs - Motivation theories - Motivational Techniques - Job Enrichment - Communication - Process of Communication - Barriers and Breakdown - Effective Communication - Electronic media in Communication.

UNIT V CONTROLLING **9**

System and process of Controlling - Requirements for effective control - The Budget as Control Technique - Information Technology in Controlling - Use of computers in handling the information - Productivity - Problems and Management - Control of Overall Performance - Direct and Preventive Control - Reporting - The Global Environment - Globalization and Liberalization - International Management and Global theory of Management.

TOTAL : 45

TEXT BOOKS

1. Harold Kooritz & Heinz Weihrich Essentials of Management, Tata McGraw-Hill, 1998
2. Joseph L Massie Essentials of Management, Prentice Hall of India, (Pearson) 2009.

REFERENCES

1. Tripathy PC And Reddy PN, Principles of Management, Tata McGraw-Hill, 1999.
2. Decenzo David, Robbin Stephen A, Personnel and Human Resources Management, Prentice Hall of India, 1996
3. JAF Stomer, Freeman R. E and Daniel R Gilbert, Management, Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, Engineering Management, Addison Wesley,-2000.

CY 2002 ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

GOAL

To create an awareness of environment degradation and its protection.

OBJECTIVES

The course should enable the students to:

1. Learn the various environmental pollution aspects and issues.
2. Understand the comprehensive insight into natural resources, ecosystem and biodiversity.
3. Know the ways and means to protect the environment from various types of pollution.

OUTCOME

The students should be able to:

1. Know the various natural resources available.
2. Know the effect of various Human activities affecting our Natural resources.
3. Understand the various Environmental Pollution aspects and Issues involved.
4. Appreciate the need of Sustainable Development.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance - need for public awareness - forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems - mineral resources: use effects on forests and tribal people - water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies - food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies - land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification - role of an individual in conservation of natural resources - equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets - river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - introduction to biodiversity - definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - biodiversity at global, national and local levels - India as a mega-diversity nation - hot-spots of biodiversity - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 8

Definition - causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - solid waste management: causes, effects and control measures of urban and industrial wastes - role of an

individual in prevention of pollution - pollution case studies - disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site - urban / rural / industrial / agricultural

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **7**

From unsustainable to sustainable development - urban problems related to energy - water conservation, rain water harvesting, watershed management - resettlement and rehabilitation of people; its problems and concerns, case studies - environmental ethics: issues and possible solutions - climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies - wasteland reclamation - consumerism and waste products - environment protection act - air (prevention and control of pollution) act - water (prevention and control of pollution) act - wildlife protection act - forest conservation act - issues involved in enforcement of environmental legislation - public awareness

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS - women and child welfare - role of information technology in environment and human health - case studies.

TOTAL : 45

TEXT BOOKS

1. Gilbert M.Masters, Introduction to Environmental Engineering and Science, pearson education Pvt., Ltd., second edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. jr., Environmental Science, Wadsworth publishing co.
3. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell science.
4. Trivedi R.K. and P.K. Goel, Introduction to air pollution, techno-science publications.

REFERENCES

1. Bharucha erach, The Biodiversity of India, mapin publishing Pvt. Ltd., Ahmedabad India,
2. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.

ME 2601 DESIGN OF TRANSMISSION SYSTEM

L	T	P	C
3	1	0	4

GOAL

To expose the students on the principles and procedure for the design of power Transmission components

OBJECTIVES

The course should enable the students to:

1. Learn the principles and procedure for the design of power Transmission components.
2. Understand the standard procedure available for Design of Transmission Systems using standard data and catalogues
3. Calculate the force on the tooth.

OUTCOME

The students should be able to:

1. Select the Belts, Pulleys, Wire ropes, Transmission Chains and Sprockets for different applications.
2. Design Pulleys and Sprockets.
3. Know about Gear Terminology and various types of Gears and its applications.
4. Design Gear Boxes, Cam and Clutches.

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 12

Selection of V belts and pulleys - selection of Flat belts and pulleys - Wire ropes and pulleys - Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 12

Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials - Module and Face width-power rating calculations based on strength and Darabiling considerations - Parallel axis Helical Gears - Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 12

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.

Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

Crossed helical gear: Terminology - helix angles - Estimating the size of the pair of cross helical gears.

UNIT IV DESIGN OF GEAR BOXES **12**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Constant mesh gear box. - Design of multi speed gear box.

UNIT V DESIGN OF CAM, CLUTCHES AND BRAKES **12**

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface contail stresses.

Design of plate clutches -axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes.

TOTAL : 60

TEXT BOOKS

1. Juvinall R. C., Marshek K.M., Fundamentals of Machine component Design - John Wiley & Sons Third Edition, 2002.
2. Bhandari, V.B., Design of Machine Elements, Tata McGraw-Hill Publishing Company Ltd., 2010.

REFERENCES

1. Maitra G.M., Prasad L.V., Hand book of Mechanical Design, II Edition, Tata McGraw-Hill, 1985.
2. Shigley J.E and Mischke C. R., Mechanical Engineering Design, McGraw-Hill International Editions,New Delhi 2010..
3. Prabhu. T.J., Design of Transmission Elements, Mani Offset, Chennai, 2002,
4. Norton R.L, Design of Machinery, McGraw-Hill Book co, 2004.
5. Hamrock B.J., Jacobson B., Schmid S.R., Fundamentals of Machine Elements, McGraw-Hill Book Co., 1999.
6. Gear Design - Darle Dudley

STANDARDS - IS 4460

1. Parts 1 to 3:1995, Gears - Spur and Helical Gears - Calculation of Load Capacity.
2. I S 7443 : 2002, Methods of Load Rating of Worm Gears
3. I S 15151: 2002, Belt Drives - Pulleys and V-Ribbed belts for Industrial applications -PH, PJ, PK, Pl and PM Profiles : Dimensions
4. I S 2122 : Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 1 Flat Belt Drives.
5. I S 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 2 V-Belt Drives.

ME 2602 HEAT TRANSFER

L	T	P	C
3	1	0	4

GOAL

The course is intended to build up necessary background for understanding the physical behaviour of various modes of heat transfer like conduction, convection and radiation

OBJECTIVES

The course should enable the students to:

1. Learn the physical behaviour of various modes of heat transfer like conduction, convection and radiation.
2. Know the application of various experimental heat transfer correlations in engineering calculations.
3. Understand the thermal analysis and sizing of heat exchangers.
4. Understand the concepts of Radiation Heat Transfer.
5. Learn the concepts of boundary layer and its importance in convection phenomenon.

OUTCOME

The students should be able to:

1. Understand the difference between various modes of Heat Transfer.
2. Learn the Thermal Resistance Concept used in Heat Conduction.
3. Use the basic methods in Conduction and Understand the concepts of transient conduction heat transfer and its applications.
4. Learn to apply various correlations used in Convective Heat Transfer.
5. Design/size Heat Exchanger.

UNIT I CONDUCTION **12**

Basic Concepts - Mechanism of Heat Transfer - Conduction, Convection and Radiation - General Differential equation of Heat Conduction - Fourier Law of Conduction - Cartesian and Cylindrical Coordinates - One Dimensional Steady State Heat Conduction - Conduction through Plane Wall, Cylinders and Spherical systems - Composite Systems - Critical Thickness of Insulation - Conduction with Internal Heat Generation

UNIT II ONE DIMENSIONAL HEAT CONDUCTION **12**

Extended Surfaces: Fins - rectangular and pin fins - Fin effectiveness and efficiency.

Unsteady Heat Conduction: Lumped parameter approach and physical significance of time constant - Biot number - Validity of lumped parameter approach. Introduction to Heissler Chart.

Numerical methods for heat conduction.

UNIT III CONVECTION **12**

Basic Concepts - Convective Heat Transfer Coefficients - Boundary Layer Concept - Types of Convection - Forced Convection - Dimensional Analysis - External Flow - Flow over Plates, Cylinders and Spheres - Internal Flow - Laminar and Turbulent Flow - Combined Laminar and Turbulent Heat Transfer - Flow over Bank of tubes - Free Convection - Dimensional Analysis - Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT IV RADIATION **12**

Basic Concepts, Laws of Radiation - Stefan Boltzman Law, Kirchoff Law - Black Body Radiation - Grey body radiation - Shape Factor Algebra - Electrical Analogy - Radiation Shields - Introduction to Gas Radiation.

UNIT V HEAT EXCHANGERS **12**

Types of Heat Exchangers - LMTD Method of heat Exchanger Analysis - Correction Factors - Effectiveness - NTU method of Heat Exchanger Analysis - Overall Heat Transfer Coefficient - Fouling Factors.

TOTAL : 60

TEXT BOOKS

1. Ozisik M.N, Heat Transfer, McGraw-Hill Book Co., 1994.
2. Nag P.K, Heat Transfer, Tata McGraw-Hill, New Delhi, 2002

REFERENCES

1. Holman J.P Heat and Mass Transfer Tata McGraw-Hill, 2000.
2. Frank P. Incropera and David P. DeWitt, Fundamentals of Heat and Mass Transfer, John Wiley and Sons, 2010.
3. Sachdeva R C, Fundamentals of Engineering Heat and Mass Transfer New Age International, 2010.

ME 2603 INDUSTRIAL AUTOMATION & ROBOTICS

L	T	P	C
3	0	0	3

GOAL

To expose the students in basic concepts of robots, familiarise them with the various drive systems for robot, sensors and their applications in robots, programming of robots.

OBJECTIVES

The course should enable the students to:

1. Learn the basic concepts, parts of robots and types of robots
2. Understand the various drive systems for robot, sensors and their applications in robots, programming of robots
3. Learn the various applications of robots, justification, implementation and safety of robots.

OUTCOME

The students should be able to:

1. Understand the various drive systems for robot, sensors and their applications in robots, programming of robots
2. Have a knowledge in Image Processing
3. Having knowledge in usage of various Mechanisms in Robot applications.

UNIT I FUNDAMENTALS OF ROBOT **7**

Robot - Definition - Robot Anatomy - Co-ordinate Systems, Work Envelope, types and classification - Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Robot Parts and their Functions - Need for Robots - Different Applications

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS **10**

Pneumatic Drives - Hydraulic Drives - Mechanical Drives - Electrical Drives - D.C. Servo Motors, Stepper Motor, A.C. Servo Motors - Salient Features, Applications and Comparison of all these Drives

End Effectors - Grippers - Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT III SENSORS AND MACHINE VISION **10**

Requirements of a sensor, Principles and Applications of the following types of sensors - Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors

Camera, Frame Grabber, Sensing and Digitizing Image Data - Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis - Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms. Applications - Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) - Deviations and Problems

Teach Pendant Programming, Lead through programming, Robot programming Languages - VAL Programming - Motion Commands, Sensor Commands, End effecter commands, and Simple programs

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 8

RGV, AGV; Implementation of Robots in Industries - Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots - Pay back Method, EUAC Method, Rate of Return Method.

TOTAL : 45

TEXT BOOK

1. M.P.Groover, Industrial Robotics - Technology, Programming and Applications, McGraw- Hill, 2001

REFERENCES

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw-Hill Book Co
2. Yoram Koren, Robotics for Engineers, McGraw-Hill Book Co.
3. Janakiraman.P.A., Robotics and Image Processing, Tata McGraw-Hill.

ME 2604 IC ENGINE AND STEAM TURBINE

L	T	P	C
3	0	0	3

GOAL

To expose the students in concepts of fuels and combustion , and analysis of Steam Turbines

OBJECTIVES

The course should enable the students to:

1. Know the advanced concepts of fuel and combustion
2. Know the concepts of steam, its working principle and flow through the blades
3. Understand Fuel Injection systems used in SI and CI Engine.
4. Understand Principle of working of IC Engine and types.

OUTCOME

The students should be able to:

1. Compare the Cycles.
2. Understand the process of Combustion related to SI and CI Engines and the methods of reduction of detonation of the same.
3. Understand the details of Steam Turbines.
4. Understand the concepts of Flow through the Turbine Blades.

UNIT I I.C. ENGINE **12**

Principle of working; basic engine types; comparison of air standard cycles; air cycle analysis with variable specific heats; introduction to fuel air cycle analysis; actual cycles; mep; thermal efficiency.

Availability analysis for engine processes.

UNIT II COMBUSTION **12**

Combustion calculations related to I.C. Engine fuels. Desirable characteristics of fuels for I.C. Engine. Mixture requirements for S.I Engine; carburation pressure drop - flow relation; fuel air ratio; complete carburetor. Petrol injection. Ignition system in S.I. Engine : Battery, Magneto, and electronic ignition systems; ignition timing and spark advance.

Fuel oil injection in C.I. Engine ; fuel injection systems; injection pumps and nozzles.

UNIT III SUPERCHARGING AND SCAVENGING **12**

Theories of combustion in S.I and C. I. Engines - methods for reduction of detonation and knock; Octane number and Cetane number.

Supercharging and Scavenging: Supercharging in I.C. Engine; supercharging limits; Scavenging of I.C. engines, two stroke S.I. and C.I. engines; scavenging parameters; ideal scavenging processes; actual scavenging; scavenging pumps.

UNIT IV STEAM TURBINE **12**

Steam Generation - introduction to Boilers; Principles of action of turbines, classification, relative advantages of turbines as prime movers, isentropic flow through nozzle, nozzle shape, critical pressure ratio and maximum flow, effect of friction in nozzle flow, under-expansion and over-expansion in nozzles, supersaturated flow through nozzles.

UNIT V FLOW THROUGH TURBINE BLADE **12**

Flow through impulse turbine blade, velocity diagram, blade work, blade efficiency, optimum velocity ratio, multi-staging and its advantage, velocity compounded impulse turbine, pressure compounded impulse turbine, reheat factor, internal efficiency, state point locus.

Flow through reaction turbine blade, velocity diagram, degree of reaction, blade work, blade height, stage efficiency, optimum velocity ratio, axial thrust in reaction turbine, erosion of turbine blades.

TOTAL : 60

TEXT BOOKS

1. Internal Combustion Engines by V.Ganesan, TMH.
2. Gas Turbine Theory, Cohen, Pearson Education

REFERENCES

1. The Internal Combustion Engine - Theory and Practice Vols. I & II by C.F.Taylor, MIT Press.
2. Steam and Gas Turbines by R.Yadav, Central Book Depot.
3. Theory and Design of Steam and Gas Turbines by Lee

ME 2631 THERMAL ENGINEERING LAB-II

L	T	P	C
0	0	3	2

GOAL

To impart experimental knowledge on the performance and operations of I.C. Engines and steam generators

OBJECTIVES

The course should enable the students to:

1. Learn about IC engines, lubricants and fuels
2. Understand the Various dynamometers used for testing IC engines,
3. Learn Operating boilers and understand the turbines and power generation

OUTCOME

The students should be able to:

1. Conduct experiments on fuels and lubricants.
2. Analyze the performance of diesel and petrol engines used in automobiles.
3. Analyse energy transformation in steam turbines and boilers

LIST OF EXPERIMENTS

I.C ENGINE LAB AND FUELS LAB **30**

1. Valve Timing and Port Timing Diagrams.
2. Performance Test on 4-stroke Diesel Engine.
3. Heat Balance Test on 4-stroke Diesel Engine.
4. Morse Test on Multicylinder Petrol Engine.
5. Retardation Test to find Frictional Power of a Diesel Engine.
6. Determination of Viscosity - Red Wood Viscometer.
7. Determination of Flash Point and Fire Point.

STEAM LAB **15**

1. Study of Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

TOTAL : 45

LIST OF EQUIPMENTS (For a batch of 30 students)

1.	I.C Engine - 2 stroke and 4 stroke model	-	1 set
2.	Red Wood Viscometer	-	1 No.
3.	Apparatus for Flash and Fire Point	-	1 No.
4.	4-stroke Diesel Engine with mechanical loading.	-	1 No.
5.	4-stroke Diesel Engine with hydraulic loading.	-	1 No.
6.	4-stroke Diesel Engine with electrical loading.	-	1 No.
7.	Multi-cylinder Petrol Engine	-	1 No.
8.	Single cylinder Petrol Engine	-	1 No.
9.	Data Acquisition system with any one of the above engines	-	1 No.
10.	Steam Boiler with turbine setup	-	1 No.

ME2632 HEAT TRANSFER LAB

L	T	P	C
0	0	3	2

GOAL

To understand the fundamental modes of heat transfer by doing experiments in various heat transfer equipment, observing data and analyzing the results.

Objectives

The course should enable the students to:

1. Conduct experiments on various heat transfer modes like conduction, convection and radiation
2. Acquire practical knowledge on working principles of heat exchanger, conduction, convection and radiation heat transfer apparatus.

OUTCOME

The students should be able to:

1. Understanding the fundamentals of conduction and convection and radiation through experiments .
2. Minimize the heat loss by effective transfer.

LIST OF EXPERIMENTS

HEAT TRANSFER **45**

1. Thermal conductivity measurement by guarded plate method
2. Thermal conductivity of pipe insulation using lagged pipe apparatus
3. Natural convection heat transfer from a vertical cylinder
4. Forced convection inside tube
5. Heat transfer from pin-fin (natural & forced convection modes)
6. Determination of Stefan-Boltzmann constant
7. Determination of emissivity of a grey surface
8. Effectiveness of Parallel/counter flow heat exchanger

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)

1.	Guarded plate apparatus	- 1 No.
2.	Lagged pipe apparatus	- 1 No.
3.	Natural convection-vertical cylinder apparatus	- 1 No.
4.	Forced convection inside tube apparatus	- 1 No.
5.	Pin-fin apparatus	- 1 No.
6.	Stefan-Boltzmann apparatus	- 1 No.
7.	Emissivity measurement apparatus	- 1 No.
8.	Parallel/counter flow heat exchanger apparatus	- 1 No.
9.	Refrigeration test rig	- 1 No.
10.	Air-conditioning test rig	- 1 No.

EL 2431 COMMUNICATION SKILLS & PERSONALITY DEVELOPMENT

L	T	P	C
2	0	2	3

GOAL

The goal of the programme is to provide the learners with the methods and materials required for becoming accomplished personalities through the medium of English.

OBJECTIVES

The course is expected to enable students to:

1. Be aware of self-knowledge by exposure to soft skills, values, behaviour, attitudes, temperamental changes, and a positive attitude to life.
2. Learn personality traits and undergo personality tests to determine their own personality characteristics and the scope for improvement.
3. Cultivate the art of speaking fluently making use of proper gestures, tone and voice modulation, adding humour to the speech.
4. Figure out the need to work in teams, adorn or accept team leadership, and make use of body language to enhance team spirit.
5. Be familiar with the art of managing self, people, work and time, keeping in mind problems like time-wasters and stress-builders.

OUTCOME

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

1. Apply the knowledge gained to improve upon their values, behaviour, attitude, and develop the soft skills required for home, workplace and the society.
2. Employ the concept of personality traits and build up an accomplished personality that would be pleasing to people around so as to influence them positively.
3. Develop a personal style and communicate fearlessly and effectively in a convincing manner so as to impress listeners or the audience.
4. Participate in presentations, group discussions, debates and mock interviews making good use of language skills and interpersonal relationships.
5. Comprehend stress-management tips to overcome stress-prone habits and develop a career plan with personal, familial and societal goals for success.

UNIT I **12**

Values and attitudes - Value-formation - Values & education - Terminal & Instrumental values - Civic responsibilities - The power of Personal/ Cultural/ Social valves -- Behaviour and attitudes -- Features of attitudes - Developing positive attitude - Overcoming negative attitude -- People skills - Soft skills as per the Work Force Profile - The four temperaments - Sanguine - Choleric - Melancholic - Phlegmatic -- Tests for Personal Chemistry.

UNIT II **12**

What is personality development? - Types of personalities as per (i) Heredity (ii) Environment (iii) Situation - the 16 personality factors - MBTI Tests - Personality types - Increasing self awareness: Assessing one's locus of control, Machiavellianism, self-esteem, self-monitoring, risk-taking, Type A, Type B personality elements - Intellectual and physical abilities for jobs -- Personality tests.

UNIT III **12**

Developing the art of speaking - How to get rid of stage fright? - Enhancing fluency - Modulating voice - Enunciation - Positive and negative gestures - Preparation - How to begin? - How to convince the listeners? - How to wind up the speech? - Adding humour and illustration - Developing one's own style - Types of style - How to influence the audience? - How to become an effective speaker? -- Tests for effective speaking.

UNIT IV **12**

Team work - Team building - Team leadership -- How to face an interview? -- How to participate in a group discussion? - How to argue for or against in a debate? - Body language - non-verbal communication - personal appearance - facial expression - posture - gestures - eye contact - Etiquette - Voluntary and involuntary body language -Gender implications -- Tests.

UNIT V **12**

Managing self, people, work, situations - Time-management - Secrets of time-management - Time-wasters - Stress -- Kinds of stress - Spotting stress - Stress-builders - Stress -management tips - Stress-prone habits -- Goals - Career planning - Interpersonal interaction - Interpersonal relationships -- Tests.

TOTAL : 60

REFERENCES

1. Burlington, V.T. Group Interaction in High Risk Environments. Ashgate Publication, 2004.
2. Fisher, Kimball. Leading Self-directed Work Terms: A Guide to Developing New Team Leadership Skills. New York, NY: McGraw Hill, 2000.
3. Ted W. Engstrom and R. Alec Mackenzie. Managing Your Time: Practical Guidelines on the Effective Use of Time. 2008.
4. Burnard, Philip. Training Games for Interpersonal Skills. McGraw Hill, Inc., New York, 1992.
5. Greenwich, Carolyn. The Fun Factor, McGraw Hill, Inc., New York, 1997.

Study material will be prepared by the Department of Languages.

Tests suggested will be prepared by a senior faculty of the department.

Movies will be screened to discuss and debate on the topics introduced in each unit.

Laboratory Requirements:

1. Career Lab:1 room
2. 2 Computers as a Server for Labs (with High Configuration)
3. Headphones with Mic (i-ball) - 100 Nos
4. Speakers with Amplifiers, Wireless Mic and Collar Mic - 2 Sets
5. Teacher table, Teacher Chair - 1 + 1
6. Plastic Chairs - 75 Nos.

ME 2633 DESIGN PROJECT-I

L	T	P	C
0	0	6	2

GOAL

To design and fabricate a device/machine/equipment 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.

OUTCOMES

The students should be able to:

1. Complete understanding of making a product is achieved
2. Knowledge on preparing a technical report is gained

NOTES

- The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.
- The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.
- The students are required to design and fabricate the chosen item and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

SEMESTER VII

MG 2002 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

GOAL

To understand the various aspects related to quality, and to implement Total Quality Management practices in an organization improvement.

OBJECTIVES

The course will enable the students:

(i) To understand the Total Quality Management concepts and principles and the various tools available to achieve Total Quality Management in an organizational setting

(ii) Explain the importance of Statistical Process Control (SPC), methods in testing and measuring quality acceptance, quality standards for product and services in an organization using seven management tools.

(iii) To explain the statistical approach for quality control.

(iv) To create an awareness about the ISO and QS certification process and its need in an organization.

OUTCOME

After completion of the course the learner will be able to:

(i) Appreciate quality and understands various dimensions of quality, aspects that are related to quality cost, and methods to implement quality in an organization.

(ii) Have a clear understanding of customer perception and the need for ensuring quality of products or services and ways to attain customer satisfaction.

(iii) Explain the importance of Statistical Process Control (SPC), methods in testing and measuring quality acceptance, quality standards for product and services in an organization using seven management tools.

(iv) Clearly understand the various ISO standards and procedures involved in assuring and ensuring quality.

UNIT I INTRODUCTION **9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership - Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES **9**

Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition

and Reward, Performance Appraisal, Benefits, Continuous Process Improvement - Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals - Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS 9

Benchmarking - Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) - House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) - Concept, Improvement Needs, FMEA - Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System - Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 - Concept, Requirements and Benefits.

TOTAL : 45

TEXT BOOK

1. Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCES

1. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2005 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. Total Quality Management, McGraw Hill, 1991.
3. Oakland.J.S. Total Quality Management, Butterworth - Hcinemann Ltd., Oxford. 1989.
4. Narayana V. and Sreenivasan, N.S. Quality Management - Concepts and Tasks, New Age International 1996.
5. Zeiri. Total Quality Management for Engineers, Wood Head Publishers, 1991.

ME 2701 FINITE ELEMENT METHODS

L	T	P	C
3	1	0	4

GOAL

To train the students in the principles involved in discretisation and finite element approach.

OBJECTIVES

The course should enable the students to:

1. Learn the principles involved in discretization and finite element approach
2. Form stiffness matrices and force vectors for simple elements
3. Find the various approach followed in Finite Element approach.
4. Use the various elements for discretisation.
5. Learn about shape functions.

OUTCOME

The students should be able to:

1. Know about discretion techniques, matrix algebra.
2. Learn about the Classical techniques in Finite Element Method.
3. Learn about various elements and when to choose them.
4. Form the stiffness matrix and solve them.
5. Do stress calculation for the components used in the Industries using the software.

UNIT I INTRODUCTION **12**

Historical background - Matrix approach - Application to the continuum - Discretisation - Matrix algebra - Gaussian elimination - Governing equations for continuum - Classical Techniques in FEM - Weighted residual method - Ritz method

UNIT II ONE DIMENSIONAL PROBLEMS **12**

Finite element modeling - Coordinates and shape functions- Potential energy approach - Galarkin approach - Assembly of stiffness matrix and load vector - Finite element equations - Quadratic shape functions - Applications to plane trusses

UNIT III TWO DIMENSIONAL CONTINUUM **12**

Introduction - Finite element modelling - Scalar valued problem - Poisson equation -Laplace equation - Triangular elements - Element stiffness matrix - Force vector - Galarkin approach - Stress calculation - Temperature effects

UNIT IV AXISYMMETRIC CONTINUUM **12**

Axisymmetric formulation - Element stiffness matrix and force vector - Galarkin approach - Body

forces and temperature effects - Stress calculations - Boundary conditions - Applications to cylinders under internal or external pressures - Rotating discs

UNIT V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM 12

The four node quadrilateral - Shape functions - Element stiffness matrix and force vector - Numerical integration - Stiffness integration - Stress calculations - Four node quadrilateral for axisymmetric problems.

TOTAL : 60

TEXT BOOKS

1. Reddy J.N., An Introduction to Finite Element Method, McGraw-Hill International Student Edition, 2010
2. Chandrupatla T.R., and Belegundu A.D., Introduction to Finite Elements in Engineering, Pearson Education 2002, 3rd Edition.
3. David V Hutton Fundamentals of Finite Element Analysis 2005. McGraw-Hill Int. Ed.

REFERENCES

1. Rao S.S., The Finite Element Method in Engineering, Pergammon Press, 2008.
2. Logan D.L., A First course in the Finite Element Method, Third Edition, Thomson Learning, 2002.
3. Robert D.Cook., David.S, Malkucs Michael E Plesha, Concepts and Applications of Finite Element Analysis 4 Ed. Wiley, 2008.
4. O.C.Zienkiewicz and R.L.Taylor, The Finite Element Methods, Vol.1, The basic formulation and linear problems, Vol.1, Butterworth Heineman, 5th Edition,2000.

ME 2702 MECHATRONICS

L	T	P	C
3	0	0	3

GOAL

To expose the students in the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.

OBJECTIVES

The course should enable the students to:

1. Understand the usage of Sensors and Transducers.
2. Understand the various systems involved in Mechatronics.
3. Learn the Various actuator systems and Understand System Models and their Controllers.
4. Know the Programming Logic Controller
5. Do Process in Designing the System.

Outcome

The students should be able to:

1. Select the proper Sensors.
2. Know the various Actuation Systems.
3. Design the Building blocks of Mechanical, Electrical, Fluid and Thermal Systems
4. Understand the concepts of Programmable Logic Controllers.
5. Design the Mechatronics Systems.

UNIT I MECHATRONICS, SENSORS AND TRANSDUCERS 9

Introduction to Mechatronics Systems - Measurement Systems - Control Systems - Microprocessor based Controllers.

Sensors and Transducers - Performance Terminology - Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors - Selection of Sensors

UNIT II ACTUATION SYSTEMS 9

Pneumatic and Hydraulic Systems - Directional Control Valves - Rotary Actuators. Mechanical Actuation Systems - Cams - Gear Trains - Ratchet and Pawl - Belt and Chain Drives - Bearings.

Electrical Actuation Systems - Mechanical Switches - Solid State Switches - Solenoids - D.C Motors - A.C Motors - Stepper Motors.

UNIT III SYSTEM MODELS AND CONTROLLERS 9

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational - Translational Systems, Electromechanical Systems - Hydraulic - Mechanical Systems.

Continuous and discrete process Controllers - Control Mode - Two - Step mode - Proportional Mode - Derivative Mode - Integral Mode - PID Controllers - Digital Controllers - Velocity Control - Adaptive Control - Digital Logic Control - Micro Processors Control.

UNIT IV PROGRAMMING LOGIC CONTROLLERS 9

Programmable Logic Controllers - Basic Structure - Input / Output Processing - Programming - Mnemonics - Timers, Internal relays and counters - Shift Registers - Master and Jump Controls - Data Handling - Analogs Input / Output - Selection of a PLC Problem.

UNIT V DESIGN OF MECHATRONICS SYSTEM 9

Stages in designing Mechatronics Systems - Traditional and Mechatronic Design - Possible Design Solutions Case Studies of Mechatronics Systems, Pick and place robot - automatic Car Park Systems - Engine Management Systems.

TOTAL: 45

TEXT BOOK

1. W. Bolton, Mechatronics, Pearson Education, 4th Edition, 2010..

REFERENCES

1. Michael B. Histand and David G. Alciatore, Introduction to Mechatronics and Measurement Systems, McGraw-Hill International Editions, 3rd edition , 2009.
2. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, Mechatronics, Chapman and Hall, 2004.
3. Dan Necsulesu, Mechatronics, Pearson Education Asia, 2002 (Indian Reprint).
4. Lawrence J. Kamm, Understanding Electro - Mechanical Engineering, An Introduction to Mechatronics, Prentice - Hall of India Pvt., Ltd., 2000.
5. Nitaigour Premchand Mahadik, Mechatronics, Tata McGraw-Hill publishing Company Ltd, 2003

ME 2703 POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

GOAL

To expose the students in various components, operations and applications of different types of power plants.

OBJECTIVES

The course should enable the students to:

1. Know the Layout of various types of Power Plant.
2. Understand the details of Steam Boilers and the Cycles.
3. Know about Nuclear Power plants
4. Understand the Economics of various Power Plants.

OUTCOME

The students should be able to:

1. Understand process of working of Steam Boilers, Combustion equipment.
2. Know the Fuel and Ash Handling Units.
3. Know the principle of working of the Nuclear Power Plant.
4. Compare the economics of various types of Power Plants.

UNIT I INTRODUCTION TO POWER PLANTS & BOILERS 9

Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection, Load Duration Curves.

Steam Boilers and Cycles - High Pressure and Super Critical Boilers - Fluidized Bed Boilers

UNIT II STEAM POWER PLANT 9

Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulverizer, Electrostatic Precipitator, Draught - different types, Surface Condenser Types, Cooling Towers

UNIT III NUCLEAR AND HYDEL POWER PLANTS 9

Nuclear Energy - Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety.

Hydel Power Plant - Essential Elements, Selection of Turbines, Governing of Turbines- Micro Hydel developments.

UNIT IV DIESEL AND GAS TURBINE POWER PLANT 9

Types of Diesel Plants, Components, Selection of Engine Type, Applications Gas Turbine Power Plant - Fuels - Gas Turbine Material - Open and Closed Cycles - Reheating - Regeneration and Intercooling - Combined Cycle.

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS 9

Geo thermal - OTEC - Tidel - Pumped storage - Solar thermal central receiver system. Cost of Electric Energy - Fixed and operating Costs - Energy Rates - Types of Tariffs - Economics of load sharing, comparison of economics of various power plants.

TOTAL: 45

TEXT BOOKS

1. EI- Wakil M.M, Power Plant Technology, McGraw-Hill 1994.
2. Arora S.C and Domkundwar S, A course in Power Plant Engineering, Dhanpatrai & sons New Delhi 2010.
3. Nag P.K, Power plant Engineering, Tata McGraw-Hill, New Delhi, 2010..

REFERENCES

1. G.R. Nagpal, Power Plant Engineering, Hanna Publishers, 2009.
2. K.K.Ramalingam, Power Plant Engineering, Scitech Publications, 2009.
3. G.D.Rai, Introduction to Power Plant Technology, Khanna Publishers, 1995.
4. R.K.Rajput, Power Plant Engineering, Laxmi Publications, 2005.
5. Frank D.Graham Power Plant Engineers Guide, D.B. Taraporevala Sons & Co, New Delhi, 1993.
6. T.Morse Frederick, Power Plant Engineering, Prentice Hall of India, 1998

ME 2731 COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY

L	T	P	C
0	0	3	2

GOAL

To make students understand and learn about the simulation and analysis software and the solving techniques of various engineering problems

OBJECTIVES

The course should enable the students to:

1. Learn ANSYS- Analysis Software
2. Solve techniques of various engineering problems

OUTCOME

The students should be able to:

1. Use the ANSYS software for solving various problems
2. Have a good grip on analysis of the models modelled in any of the modelling software.

LIST OF EXPERIMENTS

A. Simulation **15**

1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Lab.
2. Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
3. Simulation of cam and follower mechanism using C / MAT Lab.

Analysis (Simple Treatment only) **30**

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)

Computer System-30 Nos

17" TEF Color Monitor

Intel Core i5 /i7 processor

500 GB HDD

1GB Graphics accelerator

4 GB RAM

Color Desk Jet Printer-1 No

Software

ANSYS Version 7 or latest-licenses

C / MATLAB-licenses

ME 2732 MECHATRONICS LAB

L	T	P	C
0	0	3	2

GOAL

To expose the students in Fluid power circuits , PLC based Fluid Power Control, Actuators, controllers and Virtual Instrumentation.

OBJECTIVES

The course should enable the students to:

1. Learn the theory behind the fluid power control.
2. Understand the details and theory behind Actuators and Sensors.
3. Learn the Details and theory behind controllers and Data logging systems.
4. Do Case study - Understanding about Robots and Programming.

OUTCOME

The students should be able to:

1. Understand the concept of interfacing the various mechanical, electrical, electronics and computer systems.
2. Know about the details of hydraulic and pneumatic Systems.
3. Design the circuits for hydraulic and pneumatic systems with PLC control.
4. Know about the various mechatronics elements through case studies.

LIST OF EXPERIMENTS

1. Design and testing of fluid power circuits to control

   (i) velocity (ii) direction and (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Servo controller interfacing for open loop & closed loop.
6. Robot programing.
7. PID controller interfacing
8. Stepper motor interfacing with 8051 Micro controller

   (ii) full step resolution (ii) half step resolution
9. Modelling and analysis of basic electrical, hydraulic and pneumatic & Electro hydraulic systems using LAB VIEW

10. Computerized data logging system with control for process variables like pressure flow and temperature.

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)

1.	Basic Pneumatic Trainer Kit with manual and electrical controls	- 1 each
2.	Basic Pneumatic Trainer Kit with PLC control	- 1 No.
3.	HYDROSIM & PNEUMOSIM Software / Automation studio	- 10 sets.
4.	8051 - Microcontroller kit with stepper motor and drive circuit LABVIEW software	- 2 sets
5.	LAB VIEW software with Sensors to measure Pressure, Flow rate, direction, speed, velocity and force.	- 2 sets
6.	Robot programming	- 1 set
7.	Hydraulic kit with PLC Control	- 1 set

ME 2733 DESIGN PROJECT - II AND COMPREHENSIVE VIVA-VOCE

L	T	P	C
0	0	6	2

GOAL

To make the students innovative and skilled in design and fabrication work, also to improve the conceptual knowledge of the students.

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. Make the students come up with new ideas in their area of interest.
3. Create interest in engineering by making them to fabricate the concept of their imagination.
4. Learn the concepts more in depth by providing guidance.
5. Enhance the knowledge and understanding of the subjects thoroughly.
6. Analyse with reasoning the various concepts involved in mechanical engineering.

OUTCOME

The students should be able to:

1. Do experiment with his ideas.
2. Troubleshoot practical problems.
3. Understand the latest trends in fabrication

4. Relate their ideas with industrial applications
5. Have adequate knowledge and conceptual skills
6. Have confidence in facing interviews and written exams
7. Qualify in competitive exams

NOTE

1. The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.
2. Students will be exposed to lecture modules on Project and Thesis work followed by assignment of individual projects involving manufacturing/production/design of an engineering product. An Industrial project may also be undertaken by the student to be supervised jointly by Industry personnel and the teacher.
3. A student will have to appear for a Comprehensive Viva-Voce examination covering all the subjects before a board of examiners including an external expert.

SEMESTER - VIII

ME 2831 PROJECT WORK

L	T	P	C
0	0	24	6

GOAL

To develop the student's Skills and make Innovation in design and fabrication work from the theoretical and practical skill acquired from the previous semesters.

OBJECTIVES

The course should enable the students to:

1. Learn the objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.
2. Make the students come up with new ideas in his area of interest.
3. Learn the concepts more in depth by providing guidance.

OUTCOME

The students should be able to:

1. Get an idea and confidence in designing, analysing and executing the project.
2. Develop knowledge of latest trends in fabrication has developed and Relate their ideas with industrial applications
3. Have complete understanding of making a product.

NOTE:

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student will be assigned any one of the following types of project/thesis work:

(a) Industrial case study

(b) Preparation of a feasibility report

(c) Thesis by experimental research, and

(d) Design and development of equipment.

Each report must contain student's own analysis or design presented in the approved format.

Sessional marks will include

(a) Evaluation of the student's progress,

(b) Degree of involvement and participation,

(c) Merit of the project.

A student will have to defend his project/thesis and credit will be given on the merit of viva-voce examination.

ELECTIVES FOR SEMESTER - VII

MG 2004 MARKETING MANAGEMENT

L	T	P	C
3	0	0	3

GOAL

To expose the various techniques involved in Marketing Management

OBJECTIVES

The course should enable the students to:

1. Understand the various processes involved in Marketing and its Philosophy.
2. Learn the Psychology of consumers.
3. Formulate Strategies for Advertising, Pricing and Selling.

OUTCOME

The students should be able to:

1. Know about the Marketing Dynamics
2. Know about the Consumer behaviour.
3. Know about the Pricing strategy.
4. Know about role of Advertising.

UNIT I MARKETING PROCESS **9**

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION **9**

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL : 45

TEXT BOOKS

1. Ramasamy and Nama kumari, Marketing Environment: Planning, implementation and control the Indian context, 1990.
2. Govindarajan. M, Industrial marketing management, Vikas Publishing Pvt. Ltd, 2007.

REFERENCES

1. Philip Kolter, Marketing Management, Pearson Education . 13th Edition 2009.
2. Green Paul.E.and Donald Tull, Research for marketing decisions, Prentice Hall of India 2003.
3. Donald S. Tull and Hawkins, Marketing Reasearch, Prentice Hall of Inida-1997.
4. Philip Kotler and Gary Armstrong Principles of Marketing Prentice Hall of India, 12th Edition 2008.
5. Steven J.Skinner, Marketing, All India Publishers and Distributes Ltd. 1998.

ME 2751 UNCONVENTIONAL MACHINING PROCESSES

L	T	P	C
3	0	0	3

GOAL

To expose the student in various unconventional machining processes

OBJECTIVES

The course should enable the students to:

1. Learn the course will impart a good perspective with adequate depth to understand the unconventional machining processes
2. Learn relative advantages over conventional machining techniques.

OUTCOME

The students should be able to:

1. Know about the working principle of various Unconventional Machining Processes.
2. Understand the relative advantages over conventional techniques and their applications.

UNIT I INTRODUCTION **5**

Unconventional machining Process - Need - clarification - Brief overview of all techniques.

UNIT II MECHANICAL ENERGY BASED PROCESSES **10**

Abrasive Jet Machining - Water Jet Machining - Ultrasonic Machining. (AJM, WJM and USM).Working Principles - equipment used - Process parameters - MRR-Variation in techniques used - Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES **8**

Electric Discharge Machining (EDM)- working Principles-equipments-Process Parameters- MRR-electrode / Tool - Power Circuits-Tool Wear - Dielectric - Flushing - Wire cut EDM - Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGYBASED PROCESSES **12**

Chemical Machining and Electro-Chemical Machining (CHM and ECM)-Etchants-maskant techniques of applying maskants-Process Parameters - MRR-Applications.Principles of ECM-equipments-MRR-Electrical circuit-Process Parameters-ECG and ECH Applications.

UNIT V THERMAL ENERGY BASED PROCESSES **10**

Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types-Beam control techniques - Applications.

TOTAL : 45

TEXT BOOK

1. Vijay.K. Jain Advanced Machining Processes Allied Publishers Pvt. Ltd., New Delhi (2002) ISBN 81-7764-294-4.

REFERENCES

1. Benedict. G.F. Nontraditional Manufacturing Processes Marcel DekkerInc., NewYork(1987).
2. Pandey P.C. and Shan H.S. Modern Machining Processes Tata McGraw-Hill, New Delhi 2007.
3. Mc Geough, Advanced Methods of Machining Chapman and Hall, London (1998).
4. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, Material and Processes in Manufacturing Prentice Hall of India Pvt. Ltd., New Delhi (8th Edition) (2001) ISBN - 81-203-1243-0.

ME 2752 REFRIGERATION & AIR CONDITIONING

L	T	P	C
3	0	0	3

GOAL

To expose the principles and design of various components involved in refrigerants and air conditioning.

OBJECTIVES

The course should enable the students to:

1. Know about Refrigeration cycles
2. Understand the Various Components: its working and design
3. Know about Psychrometry and Air conditioning
4. Make Cooling load calculations

OUTCOME

The students should be able to:

1. Understand the various types of refrigeration systems and Psychrometric processes.
2. Use Psychrometric charts
3. Appreciate the requirements of comfort Air-Conditioning.
4. Know about the Air-Conditioning equipments and their applications.

UNIT I REFRIGERATION CYCLE **9**

Review of thermodynamic principles of refrigeration. Concept of Aircraft refrigeration system. Vapour compression refrigeration cycle - use of P-H charts - multistage and multiple evaporator systems - cascade system - COP comparison. Vapour absorption refrigeration system. Ammonia water and Lithium Bromide water systems. Steam jet refrigeration system.

UNIT II REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING **9**

Compressors - reciprocating & rotary (elementary treatment.) - condensers - evaporators - cooling towers. Refrigerants - properties - selection of refrigerants, Alternate Refrigerants, Refrigeration plant controls - testing and charging of refrigeration units. Balancing of system components. Applications to refrigeration systems - ice plant - food storage plants - milk -chilling plants - refrigerated cargo ships.

UNIT III PSYCHROMETRY **9**

Psychrometric processes- use of psychrometric charts - - Grand and Room Sensible Heat Factors - bypass factor - requirements of comfort air conditioning - comfort charts - factors governing optimum effective temperature, recommended design conditions and ventilation standards.

UNIT IV COOLING LOAD CALCULATIONS **9**

Types of load - design of space cooling load - heat transmission through building. Solar radiation - infiltration - internal heat sources (sensible and latent) - outside air and fresh air load -

estimation of total load - Domestic, commercial and industrial systems - central air conditioning systems.

UNIT V AIRCONDITIONING **9**

Air conditioning equipments - air cleaning and air filters - humidifiers - dehumidifiers - air washers - condenser - cooling tower and spray ponds - elementary treatment of duct design - air distribution system. Thermal insulation of air conditioning systems. - applications: car, industry, stores, and public buildings

TOTAL : 45

TEXT BOOKS

1. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd.2nd Edition , 2005.
2. Arora. C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill New Delhi, 3rd Edition, 2010.

REFERENCES

1. Roy.J Dossat, Principles of Refrigeration, Pearson Education, 4th Edition , 2006.
2. Jordon and Prister, Refrigeration and Air Conditioning, Prentice Hall of India PVT Ltd., New Delhi, 1985.
2. Stoecker N.F and Jones, Refrigeration and Air Conditioning, TMH, New Delhi,2nd Edition 1982.

ME 2753 RENEWABLE SOURCES OF ENERGY

L	T	P	C
3	0	0	3

GOAL

To expose the students on sources of energy crisis and the alternates available

OBJECTIVES

The course should enable the students to:

1. understand the principle of working and the components of different non-conventional sources of energy and their utilization.
2. Get an exposure on the power plants working with non conventional energy

OUTCOME

The students should be able to:

1. Appreciate the need of Renewable Energy and the effect of emission on global warming.
2. Know about the various forms of Renewable Energy, their principles of working.

UNIT I ENERGY AND ENVIRONMENT **9**

Primary energy sources - world energy resources-Indian energy scenario-energy cycle of the earth -

environmental aspects of energy utilization, CO2 emissions and Global warming-renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

UNIT II SOLAR ENERGY **9**

Principles of solar energy collection -.solar radiation - measurements - instruments - data and estimation- types of collectors - characteristics and design principles of different type of collectors - performance of collectors - testing of collectors. Solar thermal applications - water heaters and air heaters - performance and applications - simple calculations - solar cooling - solar drying - solar ponds - solar tower concept - solar furnace.

UNIT III WIND, TIDAL AND GEO THERMAL ENERGY **9**

Energy from the wind - general theory of windmills - types of windmills - design aspects of horizontal axis windmills - applications. Energy from tides and waves - Working principles of Tidal plants and ocean thermal energy conversion plants - power from geothermal energy - principle of working of geothermal power plants.

UNIT IV BIO ENERGY **9**

Energy from bio mass & bio gas plants -various types - design principles of biogas plants - applications. Energy from wastes - waste burning power plants - utilization of industrial and municipal wastes - energy from the agricultural wastes.

UNIT V OTHER RENEWABLE ENERGY SOURCES **9**

Direct energy conversion (Description, principle of working and basic design aspects only) - Magneto hydrodynamic systems (MHD) - thermoelectric generators - thermionic generators - fuel cells - solar cells - types, emf generated, power output, losses and efficiency and applications. Hydrogen conversion and storage systems

TOTAL : 45

TEXT BOOK

1. Rai G.D, Non conventional Energy sources (2009) Khanna Publishers, New Delhi

REFERENCES

1. Sukhatme, S.P., Solar Energy, 2nd edition, TMH, 2009.
2. Sulton, Direct Energy Conversion, McGraw-Hill, 1966.
3. Duffie and Beckmann, Solar Energy Thermal Processes, John Wiley, 1974.
4. Garg. H. P and Prakash. J., Solar Energy - Fundamentals and applications, TMH, New Delhi, 2009.
5. Ashok V Desai, Non-conventional Energy, Wiley Eastern Ltd, New Delhi,2003.

ME 2754 MECHANICAL VIBRATION

L	T	P	C
3	0	0	3

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 BASICS OF VIBRATION 9

Introduction, classification of vibration: Free and forced vibration, Undamped and damped vibration and linear and non linear vibration, Response of damped and undamped systems Under harmonic force, analysis of single degree and two degree of freedom systems, Torsional vibration, determination of natural frequencies.

UNIT II BASICS OF NOISE 9

Introduction, Amplitude, Frequency, Wavelength sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, Measurement environment, Equipment, Frequency analysis Tracking analysis Sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES 9

Noise Characteristics of Engines, engine overall noise levels, Assessment of combustion noise, Assessment of mechanical noise, Engine radiated noise, Intake and exhaust noise, Engine accessory contributed noise, Transmission noise, Aerodynamic noise, Tyre noise, Brake noise.

UNIT IV CONTROL TECHNIQUES 9

Vibration isolation, Tuned absorbers, Untuned viscous dampers, Damping treatments, Application dynamic forces generated by IC engines, engine isolation, Crank shaft damping, Modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL 9

Methods for control of engine noise Combustion noise Mechanical noise Predictive analysi, palliative

treatments and enclosures Automotive noise control principles Sound in enclosures, Sound energy absorption Sound transmission through barriers.

TOTAL :45

TEXT BOOKS

1. Theory of Vibration with Applications, Fourth Edition, W T Thomson, Chapman & Hall.
2. Singiresu S.Rao - Mechanical Vibrations - Pearson Education, 4th Edition , 2007..
3. Kewal Pujara Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

REFERENCES

1. Bernard Challen and Rodica Baranescu - Diesel Engine Reference Book - Second edition - SAE International - ISBN 0-7680-0403-9 - 1999.
2. Julian Happian-Smith - An Introduction to Modern Vehicle Design- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

ME 2755 QUALITY CONTROL & RELIABILITY ENGINEERING

L	T	P	C
3	0	0	3

GOAL

To expose the students to the concepts of quality, standards followed, sampling techniques to improve reliability.

OBJECTIVES

The course should enable the students to:

1. Introduce the concept of SQC
2. Understand process control and acceptance sampling procedure and their application.
3. Learn the concept of reliability.

OUTCOME

The students should be able to:

1. Understand the attributes in process control.
2. Appreciate the role of sampling procedure.
3. Understand the system reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10

Introduction,definition of quality, basic concept of quality, definition of SQC, benefits and limitation of

SQC, Quality assurance, Quality cost-Variation in process- factors - process capability- process capability studies and simple problems - Theory of control chart- uses of control chart -Control chart for variables - X chart, R chart and ? chart.

UNIT II PROCESS CONTROL FOR ATTRIBUTES 8

Control chart for attributes -control chart for proportion or fraction defectives - p chart and np chart - control chart for defects - C and U charts, State of control and process out of control identification in charts.

UNIT III ACCEPTANCE SAMPLING 9

Lot by lot sampling - types - probability of acceptance in single, double, multiple sampling techniques - O.C. curves - producer's Risk and Consumer's Risk. AQL, LTPD, AOQL concepts- standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING - RELIABILITY 9

Life testing - Objective - failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration - simple problems. Maintainability and availability - simple problems. Acceptance sampling based on reliability test - O.C Curves.

UNIT V QUALITY AND RELIABLITY 9

Reliability improvements - techniques- use of Pareto analysis - design for reliability - redundancy unit and standby redundancy - Optimization in reliability - Product design - Product analysis - Product development - Product life cycles.

TOTAL : 45

TEXT BOOKS

1. Grant, Eugene .L Statistical Quality Control, McGraw-Hill, 7th Edition 2006.
2. L .S.Srinath, Reliability Engineering, Affiliated East west press, 4th Edition , 2009.

REFERENCES

1. Monohar Mahajan, Statistical Quality Control, Dhanpat Rai & Sons, 2001.
2. R.C.Gupta, Statistical Quality control, Khanna Publishers,6th Edition , 2003.
3. Besterfield D.H., Quality Control, Prentice Hall, 1993.
4. Sharma S.C., Inspection Quality Control and Reliability, Khanna Publishers, 2002.
5. Danny Samson, Manufacturing & Operations Strategy, Prentice Hall, 1991
6. Connor, P.D.T.O., Practical Reliability Engineering, John Wiley, 4th Edition , 2004.

ME 2756 DESIGN OF JIGS FIXTURES & PRESS TOOLS

L	T	P	C
3	0	0	3

GOAL

To expose the students to understand the design principles of work holding and guiding devices.

OBJECTIVES

The course should enable the students to:

1. Understand the principles, functions and design practices of Jigs, Fixtures and dies for press working
2. Understand the Principles of locating principles, locating elements and clamping Devices.

OUTCOME

The students should be able to:

1. Develop the jigs and fixture design
2. Appreciate the Design considerations in forging, extrusion, casting and plastic dies

UNIT I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES 8

Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures - Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis.

UNIT II JIGS 9

Drill bushes -different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

UNIT III FIXTURES 9

General principles of boring, lathe, milling and broaching fixtures- grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component.

UNIT IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT 10

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies:Die block-die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes - strippers - knockouts-stops -pilots-Selection of standard die sets strip lay out-strip lay out calculations

UNIT V DESIGN AND DEVELOPMENT OF DIES 9

Design and development of progressive and compound dies for Blanking and piercing operations.

Bending dies - development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

TOTAL : 45

TEXT BOOKS

1. Edward G Hoffman, Jigs & Fixture Design, Thomson - Delmar Learning, Singapore, 5th Edition, 2005.
2. Donaldson. C, Tool Design, Tata McGraw-Hill,3rd Edition, 2010.

REFERENCES

1. Kempster, Jigs & Fixtures Design, The English Language Book Society, 2004.
2. Joshi, P.H., Jigs & Fixtures, Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004
3. Hiram E Grant, Jigs and Fixture Tata McGraw-Hill, New Delhi, 2009.
4. Fundamentals of Tool Design, CEEE Edition, ASTME, 1983
5. Design Data Handbook PSG College of Technology, Coimbatore,2010.

ME 2757 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

GOAL

To expose the students to numerical methods and to solve complex problems in fluid flow and heat transfer analysis using software.

OBJECTIVES

The course should enable the students to:

1. Introduce numerical modelling and its role in the field of heat transfer and fluid flow.
2. Enable the students to understand the various discretisation methods and solving methodologies.
3. Create confidence to solve complex problems in the field of heat transfer and fluid dynamics by using high speed computers.
4. Understand the process of converting the PDE to difference equations using various discretisation techniques.

OUTCOME

The students should be able to:

1. Know the equations governing fluid flow and heat transfer.
2. Appreciate the tools available for solving the algebraic equations.
3. Appreciate the problems associated with discretisation of incompressible flow

4. Solve the practical problems associated with Fluid Flow and Heat Transfer using commercial software.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of computational fluid dynamics - Governing equations of fluid dynamics - Continuity, Momentum and Energy equations - Physical boundary conditions - Time-averaged equations for Turbulent flow - Turbulence -Kinetic -Energy Equations - mathematical behaviour of PDEs on CFD: Elliptic, Parabolic and Hyperbolic equations.

UNIT II DISCRETISATION AND SOLUTION METHODOLOGIES 9

Methods of Deriving the Discretisation Equations - Taylor Series formulation - Finite difference method - Control volume Formulation.Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

UNIT III HEAT CONDUCTION 9

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

UNIT IV CONVECTION AND DIFFUSION 9

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretisation equations for two dimensional convection and diffusion.

UNIT V CALCULATION OF FLOW FIELD 9

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. Turbulence models: mixing length model, Two equation (k-?) models.s

TOTAL : 45

TEXT BOOKS

1. Versteeg, H.K, and Malalasekera, W., An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Longman, 1998

2. Ghoshdastidar, P.S., Computer Simulation of flow and heat transfer, Tata McGraw - Hill Publishing Company Ltd., 1998.

REFERENCES

1. Patankar, S.V., Numerical Heat Transfer and Fluid Flow, McGraw-Hill, 1980. Ane - Books Indian Edition.2009.

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

3. Bose, T.K., Numerical Fluid Dynamics, Narosa publishing House, 1997.

4. Muralidhar, K and Biswas Advanced Engineering Fluid Mechanics, Narosa Publishing House, New Delhi, 2nd Edition , 2006.

5. Anderson, J.D., Computational fluid dynamics - the basics with applications, 1995.

ME 2758 MODERN CONCEPTS OF ENGINEERING DESIGN

L	T	P	C
3	0	0	3

GOAL

To expose the students the concepts of integrated design processes with practical approach and make them to develop design process with appreciate of economic and other factors.

OBJECTIVES

The course should enable the students to:

1. Provide an overview of the integrated design process with a practical bias.
2. Prepare the student to understand and develop a design process leading to a realizable product with an appreciation of the economics, environmental concerns, manufacturability and product life cycle management.
3. Understand and develop a design process leading to a realizable product

OUTCOME

The students should be able to:

1. Get an overview of the integrated design process with a practical bias.
2. Appreciate the economics, environmental concerns, manufacturability and product life cycle management.
3. Understand the concept of DFM and the principles of Prototyping.

UNIT I PRODUCT DESIGN PROCESS **12**

Importance of product design - Design process - Design considerations - Morphology of design - Marketing Organisation for design - Computer aided engineering - Codes and standards - Design review - Technological innovation and design process - Product and process cycles -Societal considerations in design.

UNIT II PRODUCT PLANNING AND SPECIFICATION **10**

Opportunities identification-Evaluation-Resource allocation - Pre-project planning - Customer need identification - Establishing target specification - Setting the final specification.

UNIT III CONCEPT GENERATION, SELECTION AND TESTING **10**

Activity of concept generation - Clarification of problem - External and internal searches - Concept exploration - Result analysis - Overview of selection methodologies - Concept screening - Concept scoring - Concept testing - Choice of survey population - Survey formats - measurement of customer response - Interpretation and analysis of results.

UNIT IV PRODUCT ARCHITECTURE, INDUSTRIAL DESIGN,DESIGN FOR MANUFACTURE AND PROTOTYPING **13**

Product architecture - Implications - establishment - platform planning - system level design - Need for industrial design and its impact - The Industrial design process and its management - Assessment of quality - Overview of Design for Manufacture process - Steps in DFM-Basics principles of prototyping - Prototyping technologies - Planning for prototypes.

TOTAL : 45

TEXT BOOKS

1. Ulrich KT., and Eppinger S. D, Product Design and Development, McGraw-Hill Book Company, International Edition 2003. ISBN 007 123 273 7, 4th Edition , 2009.

REFERENCES

1. Dieter G. E., Engineering Design, McGraw-Hill Book Company, International Edition, 2000. ISBN 007 116 204 6 (Unit - I)
2. Ullman D.G, The Mechanical Design Process, McGraw-Hill Book Co, Third Edition, 2003. ISBN 007 112281 8
3. Otto, K.N., and Wood, K.L., Product Design-Techniques in Reverse Engineering and New product Development, Pearson Education, First Indian Reprint, 2004. ISBN 81 29702711
4. Yousef Haik, Engineering Design Process Vikas Publishing House, 2003.

ME 2759 THERMAL TURBO MACHINES

L	T	P	C
3	0	0	3

GOAL

To expose the students to various turbo machineries and their design aspects.

OBJECTIVES

The course should enable the students to:

1. Appreciate the unified theory applicable for all classes of turbo machines
2. Gain the fundamental knowledge about the design variations of thermal turbo machines.
3. Perform the design of the thermal turbo machines.

OUTCOME

The students should be able to:

1. Appreciate the unified theory applicable for all classes of Turbo Machines
2. Know about the construction details for all classes of Turbo Machines.
3. Gain the fundamental knowledge about the design variations of thermal turbo machines.

UNIT I INTRODUCTION TO TURBO MACHINES 9

Turbines, Pumps, Compressors, Fans and Blowers - Stages of Turbo machines - Energy transfer between fluid and rotor - Stage velocity triangles

Thermal Turbo machines - Classification - General energy equation - Modified to turbo machines - compression and expansion process - Velocity triangles - Work - T-S and H-S diagram, Total - to - Total and Total - to - Static efficiencies.

Dimensional analysis - Non dimensional parameters of compressible flow Turbo machines - Similarity laws, applications and limitations.

UNIT II CENTRIFUGAL FANS AND BLOWERS 9

Definition, selection and classifications -Types of blading design-velocity triangles - Stage Parameters - Flow analysis in impeller blades -Design parameter- Volute and Diffusers - Efficiencies and Losses - Fan noises - Causes and remedial measures.

Centrifugal Compressors: - Constructional details - Stage velocity triangles -- Stage work - Stage pressure rise - Stage efficiency - Degree of reaction - Slip factor - H-S diagram - Efficiencies - Performance characteristics.

UNIT III AXIAL FANS AND PROPELLERS 9

Definition and classifications - Stage parameters - Types of fan stages-performance characteristics.

Cascade of blades - Cascade tunnel - Blade geometry-Cascade variables-Energy transfer and loss in terms of lift and drag - Axial Flow Compressors: definition and classifications - Constructional details - Stage velocity triangles - Stage work - Stage pressure rise - H-S diagram- Stage efficiencies and losses- Degree of reaction - Radial equilibrium-Surging and Stalling - Performance characteristics.

UNIT IV AXIAL FLOW TURBINES 9

Construction details -90? IFR turbine- Stage work - Stage Velocity triangles - Stage pressure rise - Impulse and reaction stage - Effect of degree of reaction - H-S diagram - Efficiencies and Losses - Performance characteristics.

UNIT V RADIAL FLOW TURBINES AND WIND TURBINES 9

Constructional details -- Stage velocity triangles - H-S diagram - Stage efficiencies and losses -Performance characteristics.

Wind turbines: definition and classifications - Constructional details -Horizontal axis wind turbine- Power developed - Axial thrust - Efficiency.

TOTAL : 45

TEXT BOOK

1. Yahya, S.H., Turbines, Compressors and Fans, Tata McGraw-Hill Publishing Company,3rd Edition 2009..
2. Dixon S.L Fluid Mechanics, Thermodynamics of turbomachines-2nd Edition, Pergamon press, 6th edition , 2010.

REFERENCES

1. Kadambi V and Manohar Prasad- An Introduction to energy conversion-Vol.III, Turbomachines-Wiley Eastern India Ltd, 2008..
2. Shepherd D.H. - Principles of Turbomachinery- The Macmillan Company, 1969.

ME 2760 COMPOSITE MATERIALS & STRUCTURES

L	T	P	C
3	0	0	3

GOAL

To expose the students to various composites available and their manufacturing methods.

OBJECTIVES

The course should enable the students to:

1. Introduce different types of composite materials, their properties and applications.
2. Understand the advantages of Composite materials over conventional materials.

OUTCOME

The students should be able to:

1. Know about the properties, classification and applications of composites in the Industries.
2. Understand the Manufacture of composites.

UNIT I INTRODUCTION TO COMPOSITES 8

Fundamentals of composites - need for composites - Enhancement of properties - classification of composites - Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) - Reinforcement - Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNIT II POLYMER MATRIX COMPOSITES 12

Polymer matrix resins - Thermosetting resins, thermoplastic resins - Reinforcement fibres - Rovings - Woven fabrics - Non woven random mats - various types of fibres. PMC processes - Hand lay up processes - Spray up processes - Compression moulding - Reinforced reaction injection moulding - Resin transfer moulding - Pultrusion - Filament winding - Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GFRP).

UNIT III METAL MATRIX COMPOSITES 9

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantagesof MMC, Limitations of MMC, Metal Matrix, Reinforcements - particles - fibres. Effect of reinforcement - Volume fraction - Rule of mixtures. Processing of MMC - Powder metallurgy process - diffusion bonding - stir casting - squeeze casting.

UNIT IV CERAMIC MATRIX COMPOSITES **9**

Engineering ceramic materials - properties - advantages - limitations - Monolithic ceramics - Need for CMC - Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics - non oxide ceramics - aluminium oxide - silicon nitride - reinforcements - particles- fibres- whiskers. Sintering - Hot pressing - Cold isostatic pressing (CIPing) - Hot isostatic pressing (HIPing).

UNIT V ADVANCES IN COMPOSITES **7**

Carbon /carbon composites - Advantages of carbon matrix - limitations of carbon matrix Carbon fibre - chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

TOTAL : 45

TEXT BOOKS

1. Mathews F.L. and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall, London, England, 1st edition, 2005.
2. Chawla K.K., Composite materials, Springer - Verlag,2nd Edition , 2009.

REFERENCES

1. Clyne T.W. and Withers P.J., Introduction to Metal Matrix Composites, Cambridge University Press, 1993.
2. Strong A.B., Fundamentals of Composite Manufacturing, SME, 1989.
3. Sharma S.C., Composite materials, Narosa Publications, 2000.
4. Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy, IIT- Madras, December 2001.

ME 2761 PROCESS PLANNING & CONTROL

L	T	P	C
3	0	0	3

GOAL

To impart knowledge on work study and ergonomics and cost estimation.

OBJECTIVES

The course should enable the students to:

1. Understand the process planning concepts
2. Prepare cost estimation for various products after process planning

OUTCOME

The students should be able to:

1. Understand the characteristics of different types of tools and techniques available and their applications.

2. Approach the process planning activities, selection of machine based on process requirement and develop the manufacturing logic.

3. Determine data required for Cost estimation and estimate the production cost for different jobs.

UNIT I WORK STUDY AND ERGONOMICS 10

Method study - Definition - Objectives-Motion economy- Principles - Tools and Techniques- Applications - Work measurements- purpose - use - procedure - tools and techniques- Standard time -Ergonomics - principles - applications.

UNIT II PROCESS PLANNING 10

Definition - Objective - Scope - approaches to process planning- Process planning activities - Finished part requirements- operating sequences- machine selection - material selection parameters- Set of documents for process planning- Developing manufacturing logic and knowledge- production time calculation - selection of cost optimal processes.

UNIT III INTRODUCTION TO COST ESTIMATION 7

Objective of cost estimation- costing - cost accounting- classification of cost- Elements of cost.

UNIT IV COST ESTIMATION 8

Types of estimates - methods of estimates - data requirements and sources- collection of cost- allowances in estimation.

UNIT V PRODUCTION COST ESTIMATION 10

Estimation of material cost, labour cost and over heads, allocation of overheads - Estimation for different types of jobs.

TOTAL : 45

TEXT BOOK

1. Sinha.B.P., Mechanical Estimating and Costing, Tata McGraw-Hill, Publishing Co., 1995

REFERENCES

1. Phillip.F Ostwalal and Jairo Munez, Manufacturing Processes and systems, John Wiley, 2002.

2. Russell.R.S and Tailor, B.W, Operations Management, PHI, 4th Edition, 2003.

3. Chitale.A.V. and Gupta.R.C., Product Design and Manufacturing, PHI, 2nd Edition, 2007.

ME 2762 DYNAMICS AND CONTROL

L	T	P	C
3	0	0	3

GOAL

Establish the fundamental techniques for modeling dynamic systems.

Analyse and manipulate system models in the time and frequency domain.

Develop an understanding of feedback control systems and the parameters that influence their stability and performance.

OBJECTIVES

The course should enable the students to:

1. Learn Low order linear mathematical models of physical systems and their manipulation.
2. Know How negative feedback affects dynamic response and its characterization by primary analysis and performance measures.
3. Learn Fundamental mathematical tools used in system analysis and design.
4. Analyze dynamic systems using standard mathematical techniques.

OUTCOMES

The students should be able to:

1. Derive a model, making justifiable assumptions, from a description of a physical system and determine criteria for desired system performance and interpret trade-offs in different design configurations.
2. Analyze time and frequency domain response characteristics from plots, determine stability and predict responses for modified plots.
3. Apply standard design techniques to achieve satisfactory closed-loop performance.
4. Apply these skills in specific domains, e.g. Flight mechanics, vibrations and automotive systems.

UNIT I LINEAR SYSTEMS THEORY 13

Review of time domain analysis of linear systems dynamics - stability, performance measures and design process - state space and process models - example control systems.

System Representation in the s-domain: The Laplace transform and system transfer function - free/ forced behaviour and the characteristic equation - system poles and zeros, relative and absolute stability, root loci - steady-state error and the final value theorem.

UNIT II FREQUENCY RESPONSE OF LINEAR SYSTEMS 8

Sinusoidal excitation and Fourier Series - forecasting gain and phase, the frequency response function - graphical representation of frequency response, Bode plots.

UNIT III CLOSED-LOOP CONTROL SYSTEMS **8**

Open/closed loop transfer function definitions - performance measures in control system design - control system design examples - PID control system definitions and characteristics.

UNIT IV CONTROL SYSTEM STABILITY ANALYSIS **8**

Stability in the s-domain, the Root locus method - stability in the frequency domain, Nyquist criterion - performance measures in the frequency domain - gain and phase margins, closed loop frequency response.

UNIT V DESIGN OF FEEDBACK CONTROL SYSTEMS **8**

System compensation objectives and characteristics - lead-lag compensation, root locus and frequency response methods

TOTAL : 45

TEXT BOOK

1. N.S. Nise, Control System Engineering, 3rd edition, Wiley & Sons, ISBN 0-471-36601-3, 2000.
2. C. L. Phillips and R. D. Harbor, Feedback Control Systems, 4th Ed., Prentice Hall, 2000.

REFERENCES

3. J. Van de Vegte, Feedback Control Systems, 3rd Ed., Prentice Hall, 1994.
4. K. Ogata, Modern Control Engineering, 4th Ed., Prentice Hall, 2002.

ME 2763 MARINE PROPELLERS AND PROPULSION

L	T	P	C
3	0	0	3

GOAL

To impart knowledge on the Propeller, Geometry, Design, Performance and defects.

OBJECTIVES

The course should enable the students to:

1. Know Various types of Propulsion systems, Propeller geometry , Propeller theory , propeller operating environment
2. Understand the Interaction between hull and the propeller
3. Do Performance and maintenance of propellers

OUTCOME

The students should be able to:

1. Know the effect of environment on the performance.
2. Understand the Propeller theory, Cavitation and the analytical tools used in the Industry.
3. Appreciate the Hull - Propeller Interaction and its effect on the performance of Propeller.

UNIT I PROPULSION SYSTEMS AND PROPELLER GEOMETRY 9

Fixed pitch propellers, Ducted propellers, Podded and azimuthing propulsors, Contrarotating propellers, Overlapping propellers, Tandem propellers, Controllable pitch propellers, Waterjet propulsion, Cycloidal propellers paddle wheels, Magnetohydrodynamic propulsion, Superconducting motors for marine propulsion.

Frames of references, Propeller reference lines, Pitch, Rake and skew, Propeller outlines and area, Propeller drawing methods Section geometry and definition, Blade thickness distribution and thickness fraction, Blade interference limits for controllable pitch propellers, Controllable pitch propeller off-design section geometry, Miscellaneous conventional propeller geometry terminology.

UNIT II PROPELLER ENVIRONMENT & PERFORMANCE CHARACTERISTICS 9

Density of water, Salinity, Water temperature, Viscosity, Vapour pressure, Dissolved gases in sea water, Surface tension, Weather, Silt and marine organisms.

UNIT III PROPELLER THEORY, CAVITATION & NOISE 9

Momentum theory - Ranking, R.E. Froude , Blade element theory - W. Froude , Propeller Theoretical development, Burrill's analysis procedure, Lerbs analysis method, Eckhardt and Morgan's design method, Lifting surface correction factors - Morgan, Lifting surface models, Lifting-line - lifting-surface hybrid models, Vortex lattice methods, Boundary element methods, Methods for specialist propulsors, Computational fluid dynamics methods.

The basic physics of cavitation, Types of cavitation experienced by propellers, Cavitation considerations in design, Cavitation inception, Cavitation-induced damage, Cavitation testing of propellers, Analysis of measured pressure data from a cavitating propeller, Propeller - rudder interaction.

Physics of underwater sound, Nature of propeller noise, Noise scaling relationships, Noise prediction and control, Transverse propulsion unit noise, Measurement of radiated noise.

UNIT IV PROPELLER-SHIP INTERACTION, SHIP RESISTANCE AND PROPULSION 9

Bearing forces, Hydrodynamic interaction, Froude's analysis procedure, Components of calm water resistance, Methods of resistance evaluation, Propulsive coefficients, The influence of rough water, Restricted water effects, High-speed hull form resistance, Air resistance.

UNIT V SERVICE PERFORMANCE, TOLERANCE AND MAINTENANCE 9

Effects of weather, Hull roughness and fouling, Hull drag reduction, Propeller roughness and fouling, Generalized equations for the roughness-induced power penalties in ship operation, Monitoring of ship performance.

Propeller tolerances, Propeller inspection, Causes of propeller damage, Propeller repair, Welding and the extent of weld repairs, stress relief

TOTAL: 45

TEXT BOOK

1. John Carlton, Marine Propellers and Propulsion, (2nd Edition) published by Elservier limited, 2007

ME 2764 OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

GOAL

To create awareness about optimization in utilization of resources.

OBJECTIVES

The course should enable the students to:

1. Understand and apply operations research techniques to industrial applications
2. Understand Linear Programming concepts
3. To understand sequencing and game theory
4. Understand the concepts of PERT/CPM

OUTCOME

The students should be able to:

1. Understand the characteristics of different types of decision making environmental and appropriate decision making approaches and tools to be used in each type.
2. Build and solve Transportation models and assignment models.
3. Design simple models like CPM and PERT to improve decision making
4. Develop critical thinking and objective analysis decision making.

UNIT I LINEAR PROGRAMMING PROBLEM 9

Formulation - Graphical Solution - Bounded and Unbounded Solutions - Simplex Method - Big M method- Duality - Two phase Method - Dual Simplex method.

UNIT II SEQUENCING AND GAME THEORY 9

Johnson's Algorithm - Two Machine and three Machine problem - Game theory with saddle point and without saddle point - Dominance properties - Graphical Solutions. Dynamic Programming

UNIT III ASSIGNMENT AND TRANSPORTATION PROBLEM 9

Hungarian Method - Maximization and unbalanced assignment problem - Basic feasible solution of transportation problem - Mode method - Degeneracy - Unbalanced Transportation problem - Travelling Salesman Problem.

UNIT IV PERT - CPM - DECISION THEORY 9

Network diagram - Representation - Labelling - CPM - PERT probabilities of CPM - PERT probabilities of project duration - Laplace minimax, maxmini Hurwitz criterian.

UNIT V DETERMINATION OF EOQ **9**

Purchase Model with and without Shortages - Manufacturing Model with and without shortages - Probabilistic Model.

TOTAL : 45

TEXT BOOKS

1. H.A. Taha, Operations Research - An Introduction, Prentice Hall of India./Pearson Education
2. J.K. Sharma, Operations Research, Macmillan
3. Vijaykumar, Operations Research, Scitech

ME 2765 COMPUTER INTEGRATED MANUFACTURING

L	T	P	C
3	0	0	3

GOAL

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

OBJECTIVES

The course should enable the students to:

1. Introducethe 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 INTRODUCTION **8**

The meaning and origin of CIM- the changing manufacturing and management scene - External communication - Islands of automation and software-Dedicated and open systems-Manufacturing automation protocol - Product related activities of a company- Marketing engineering - Production planning - Plant operations - Physical distribution- Business and financial management.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING **10**

History of group technology- Role of G.T. in CAD/CAM integration - Part families - Classification and coding - DCLASS and MICLASS and OPITZ coding systems-Facility design using G.T. -benefits of G.T. - Cellular manufacturing.

Process planning - role of process planning in CAD/CAM integration - Approaches to computer aided

process planning -Variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS 9

Shop floor control-phases - Factory data collection system -Automatic identification methods - Bar code technology-Automated data collection system.

FMS-components of FMS - types -FMS workstation -Material handling and storage systems- FMS layout -Computer control systems-Application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION 10

CIM and company strategy - System modelling tools -IDEF models - Activity cycle diagram - CIM open system architecture (CIMOSA)- Manufacturing enterprise wheel-CIM architecture - Product data management-CIM implementation software.

Communication fundamentals- Local area networks -Topology - LAN implementations - Network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM 8

Open systems-Open system inter connection - Manufacturing automations protocol and technical office protocol (MAP /TOP) - Development of databases -Database terminology- Architecture of database systems-Data modelling and data associations -Relational data bases - Database operators - Advantages of data base and relational database.

TOTAL : 45

TEXT BOOK

1. Mikell.P.Groover Automation, Production Systems and computer integrated manufacturing, Pearson Education, New Delhi, 2008.

REFERENCES

1. Yorem koren, Computer Integrated Manufacturing system, McGraw-Hill, 1983.
2. Ranky, Paul G., Computer Integrated Manufacturing, Prentice Hall International 1986.
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe Computer Integrated Design and Manufacturing, McGraw-Hill Inc.
4. Roger Hanman Computer Intergrated Manufacturing, Addison -Wesley, 1997.
5. Mikell.P.Groover and Emory Zimmers Jr., CAD/CAM, Prentice hall of India Pvt. Ltd., New Delhi-1.1998.
6. Kant Vajpayee S, Principles of computer integrated manufacturing, Prentice Hall India, 2007.
7. Radhakrishnan P, Subramanyan S.and Raju V., CAD/CAM/CIM, 2nd Edition New Age International (P) Ltd, New Delhi. 2000.

ELECTIVE COURSE - VIII SEMESTER

GE 2001 PROFESSIONAL ETHICS & HUMAN VALUES

L	T	P	C
3	0	0	3

GOAL

To provide an appreciation of the responsibilities inherent in being a Professional Engineer.

OBJECTIVES

The course should enable the students to:

1. Create on Awareness on Engineering Ethics and Human Values
2. Appreciate the right of others

OUTCOME

The students should be able to:

1. Develop the ethical code of conduct for professional engineers - this will include personal values as well as national and international organisations / professional bodies.
2. Recognise, list and describe ethical issues and professional importance to the engineer.

UNIT I HUMAN VALUES **10**

Morals, Values and Ethics - Integrity - Work Ethic - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - caring - Sharing - Honesty - Courage - Valuing Time - Co- operation - Commitment - Empathy - Self-Confidence - Character - Spirituality.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and Chernobyl case studies.

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES **8**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

TOTAL : 45

TEXT BOOK

1. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw-Hill, New York 3rd Edition 2007.

REFERENCES

1. Charles D. Fleddermann, Engineering Ethics, Pearson Education / Prentice Hall, New Jersey, 2nd edition 2006.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, Ethics and the Conduct of Business, Pearson Education, New Delhi, 5th Edition, 2008.
4. Edmund G.Seebauer and Robert L Barry, Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.

MG 2003 ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

GOAL

Study of this subject provides an understanding of the scope of an entrepreneur,key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

OBJECTIVES

The course should enable the students to:

1. Learn the Scope of an Entrepreneur
2. Understand the Major motives influencing an Entrepreneur.
3. Know about Steps involved in Business Development.

OUTCOME

The students should be able to:

1. Know the Techno Economic Feasibility Assessment procedure.
2. Write a Project Proposal.
3. Know the various forms of Finance and support available.

UNIT I ENTREPRENEURSHIP **9**

Entrepreneur - Types of Entrepreneurs - Difference between Entrepreneur and Intrapreneur - Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION **9**

Major Motives Influencing an Entrepreneur - Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test - Stress management, Entrepreneurship Development Programs - Need, Objectives.

UNIT III BUSINESS **9**

Small Enterprises - Definition, Classification - Characteristics, Ownership Structures - Project Formulation - Steps involved in setting up a Business - identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment - Preparation of Preliminary Project Reports - Project Appraisal - Sources of Information - Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING **9**

Need - Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM - Taxation - Income Tax, Excise Duty - Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS **9**

Sickness in small Business - Concept, Magnitude, causes and consequences, Corrective measures

- Government Policy for Small Scale Enterprises - Growth Strategies in small industry - Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL : 45

TEXT BOOKS

1. S.S.Khanka Entrepreneurial Development S.Chand & Co. Ltd. Ram Nagar New Delhi,3rd edition 2010..
2. Hisrich R D and Peters M P, Entrepreneurship 6th Edition Tata McGraw-Hill, 2010.

REFERENCES

1. Rabindra N. Kanungo Entrepreneurship and innovation, Sage Publications, New Delhi,1998.
2. E DII Faulty and External Experts - A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development Institute of India, Ahmadabad, 1986.

MG 2005 ENGINEERING ECONOMICS & COST ANALYSIS

L	T	P	C
3	0	0	3

GOAL

To expose the students to basic economics and cost analysis related to engineering industries.

OBJECTIVES

The course should enable the students to:

1. Learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.
2. Understand the concept of depreciation and determination of economic life of asset.

OUTCOME

The students should be able to:

1. Understand the meaning of various terminologies like sinking fund factor, Present worth factor, capital recovery factor, Effective interest rate.
2. Appreciate the need of replacement and maintenance analysis.

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics - Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis - Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering - Function, aims, Value engineering procedure. Interest

formulae and their applications -Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW **9**

Methods of comparison of alternatives - present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS **9**

Replacement and Maintenance analysis - Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset - capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION **9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions - procedure to adjust inflation,

Examples on comparison of alternatives and determination of economic life of asset.

TOTAL : 45

TEXT BOOK

1. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES

1. Chan S.Park, Contemporary Engineering Economics, Prentice Hall of India, 3rd Edition 2008.
2. Donald.G. Newman, Jerome.P.Lavelle, Engineering Economics and analysis Engg. Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, Engineering Economy, Macmillan, NewYork, 1984
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, Principles of Engineering Economy,
5. Ronald Press, New York,1976. Smith, G.W., Engineering Economy, Lowa State Press, Iowa, 1973.

ME 2851 PRODUCTION PLANNING & CONTROL

L	T	P	C
3	0	0	3

GOAL

Learning about production types & work study, process planning & Scheduling Inventory control.

OBJECTIVES

The course should enable the students to:

1. Understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
2. Know the recent trends like Manufacturing Requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

OUTCOME

The students should be able to:

1. Get an opportunities of recent trends like Manufacturing Requirement Planning (MRP II) and Enterprise Resource Planning (ERP).
2. Appreciate the need of the various activities of Production Planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.

UNIT I INTRODUCTION **9**

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect-aesthetic aspect. Profit consideration-Standardization, Simplification & specialization-Break even analysis-Economics of a new design.

UNIT II WORK STUDY **9**

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development-Implementation - Micro motion and memo motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Pre-determined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING **9**

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING **9**

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules- Gantt charts-Perpectual loading-Basic scheduling problems - Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing - Production Control systems- Periodic batch control-

Material requirement planning kanban -Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to Computer Integrated Production Planning systems-elements of Just In Time Systems-Fundamentals of MRP II and ERP.

TOTAL : 45

TEXT BOOK

1. Martand Telsang, Industrial Engineering and Production Management, S. Chand and Company, 2nd edition, 2002.

REFERENCES

1. Samson Eilon, Elements of production planning and control, Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, Modern Production / Operations Management, 8thEd. John Wiley and Sons, 2000.
3. K.C.Jain & L.N. Aggarwal, Production Planning Control and Industrial Management, KhannaPublishers, 6th Edition , 2008.
4. N.G. Nair, Production and Operations Management, Tata McGraw-Hill, 2004.
5. S.N.Chary, Theory and Problems in Production & Operations Management, Tata McGrawHill, 2003.
6. S.K. Hajra Choudhury, Nirjhar Roy and A.K. Hajra Choudhury, Production Management, Media Promoters and Publishers Pvt. Ltd., 1998.

ME 2852 ADVANCED STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

GOAL

To expose the students the advanced concepts of stresses & deformations through mathematical models.

OBJECTIVES

The course should enable the students to:

1. Analyse the stresses and deformations through advanced mathematical models.
2. Estimate the design strength of various industrial equipments.

OUTCOME

The students should be able to:

1. Use appropriate Model the compo for the analysis.

2. Analyse the stresses and deformations through advanced mathematical models.

UNIT I ANALYSIS OF PLATES **9**

Mathematical modelling of plates with normal loads - Point and Distributed Loads - Support conditions - Rectangular plates - Stresses along coordinate axes - Plate deformations - Axi- symmetric plates - Radial and tangential stresses - plate deflections.

UNIT II THICK CYLINDERS AND SPHERES **9**

Equilibrium and compatibility conditions - Lame's Theorem - Boundary conditions - distribution of radial and tangential stresses - Compound cylinders - Interference fits - Stresses due to temperature distributions.

UNIT III ROTATING DISCS **9**

Lame-Clayperon Theorem - Radial and tangential stresses in discs due to centrifugal effects - Boundary conditions - Solid and hollow discs - Interference fit on shafts -Strengthening of the hub - residual stresses - Auto frettege - Discs of variable thickness - Disc profile for uniform strength.

UNIT IV BEAMS ON ELASTIC FOUNDATION **9**

Infinite beam subjected to concentrated load - Boundary Conditions - Infinite beam subjected to a distributed load segment - Triangular load - Semi infinite beam subjected to loads at the ends and concentrated load near the ends - Short beams.

UNIT V CURVED BEAMS AND CONTACT STRESSES **9**

Analysis of stresses in beams with large curvature - Stress distribution in curved beams - Stresses in crane hooks and C clamps - Contact Stresses - Hertz equation for contact stresses - applications to rolling contact elements.

TOTAL : 45

TEXT BOOKS

1. Boresi A.P., Schmidt R.J., Advanced Mechanics of Materials, John Wiley and Sons, Sixth edition, 2003.
2. Dally J.W. and Riley W.F, Experimental Stress Analysis, John Wiley and Sons 2003

REFERENCES

1. Burr A. H., CheathAm J.B., Mechanical Analysis and Design, Prentice Hall of India, Second edition, 2001.
2. Den-Hartog J.P., Strength of Materials, John Wiley and Sons.

ME 2853 NEW PRODUCT DESIGN AND DEVELOPMENT

L	T	P	C
3	0	0	3

GOAL

To expose the students the various aspects of design process, concepts to product costing, optimisation at the design and make form to apply in practical.

OBJECTIVES

The course should enable the students to:

1. Understand the several aspects of the design process and to apply them in practice.
2. Train the student in the concept of product costing and manufacturing economics in optimization of product design.

OUTCOME

The students should be able to:

1. Develop the concepts of product costing and other manufacturing economics in optimization of product design
2. Know about the various tools available in the product design.

UNIT I PRODUCT DESIGN AND DEVELOPMENT 8

Principles of creativity in design- integrated product development and concurrent engineering - Product analysis - Criteria for product design - Market research - Design for customer and design for manufacture - Product life cycle.

UNIT II ECONOMICS OF DESIGN 9

Breaks even point - Selection of optimal materials and processes - Material layout planning - Value analysis - Re-engineering and its impact on product development.

UNIT III PRODUCT MODELING 9

Product modelling - Definition of concept - fundamental issues - Role and basic requirement of process chains and product models -Types of product models - Model standardization efforts - types of process chains - Industrial demands.

UNIT IV PRODUCT COSTING 10

Bill of materials - Outline Process charts - Concepts of operational standard time - Work measurement by analytical estimation and synthesis of time - Budgets times - Labor cost and material cost at every stage of manufacture - W.I.P. costing

UNIT V RECENT ADVANCES AND CONCEPTS IN PRODUCT DESIGN 9

Fundamentals of FEM and its significance to product design - Product life cycle management - Intelligent information system - Concept of Knowledge based product and process design.

TOTAL : 45

TEXT BOOKS

1. Sameul Eilon - Elements of Production Planning and Control - McMillan and Company, 1962.
2. Jones S.W., Product Dosing and Process Selection, Butterworth Publications, 1973
3. Karl T. Ulrich, Stephen D. Eppinger - Product Design and Development, McGraw- Hill,4th Edition, 2009.

REFERENCES

1. Harry Nystrom - Creativity and Innovation, John Wiley & Sons, 1979
2. George E. Dieter, Engineering Design - Materials and process approach, Tata McGraw-Hill,3rd Edition , 2000.
3. Donald E. Carter - Concurrent Engineering, Addison Wesley, 1992.

ME 2854 MAINTENANCE ENGINEERING

L	T	P	C
3	0	0	3

GOAL

To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities

OBJECTIVES

The course should enable the students to:

1. Explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
2. Illustrate some of the simple instruments used for condition monitoring in industry.

OUTCOME

The students should be able to:

1. Understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2. Know about different maintenance practices followed in the industry like Preventive maintenance, condition monitoring and repair of machine elements

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 10

Basic Principles of maintenance planning - Objectives and principles of planned maintenance activity - Importance and benefits of sound Maintenance systems - Reliability and machine availability - MTBF, MTTR and MWT - Factors of availability - Maintenance organization - Maintenance economics.

UNIT II MAINTENANCE POLICIES - PREVENTIVE MAINTENANCE 9

Maintenance categories - Comparative merits of each category - Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication - TPM.

UNIT III CONDITION MONITORING **9**

Condition Monitoring - Cost comparison with and without CM - On-load testing and off-load testing - Methods and instruments for CM - Temperature sensitive tapes - Pistol thermometers - wear-debris analysis

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS **10**

Repair methods for beds, slideways, spindles, gears, lead screws and bearings - Failure analysis - Failures and their development - Logical fault location methods - Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT **8**

Repair methods for Material handling equipment - Equipment records -Job order systems-Use of computers in maintenance.

TOTAL : 45

TEXT BOOKS

1. Srivastava S.K., Industrial Maintenance Management, - S. Chand and Co., 1981
2. Bhattacharya S.N., Installation, Servicing and Maintenanc, S. Chand and Co., 1995

REFERENCES

1. White E.N., Maintenance Planning, I Documentation, Gower Press, 1979.Garg M.R., "Industrial Maintenance", S. Chand & Co., 1986.
2. Higgins L.R., Maintenance Engineering Hand book, McGraw Hill, 5th Edition, 1988.
3. Armstrong, Condition Monitoring, BSIRSA, 1988.
4. Davies, Handbook of Condition Monitoring, Chapman &Hall, 1996.
5. Advances in Plant Engineering and Management, Seminar Proceedings - IIPE, 1996.

ME 2855 NON DESTRUCTIVE TESTING METHODS

L	T	P	C
3	0	0	3

GOAL

To impart knowledge on Non Destructive Testing procedures.

OBJECTIVES

The course should enable the students to:

1. Understand principle behind various NDT techniques and study about NDT equipments and accessories.
2. Learn working procedures of various NDT techniques
3. Learn materials that could be inspected - codes, standards, specifications.

OUTCOME

The students should be able to:

1. Know about NDT equipments and accessories.
2. Develop the NDT techniques in practical applications.
3. Compare and select of various NDT techniques based on the applications

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION 9

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 9

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 9

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 9

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 9

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

TOTAL : 45

TEXT BOOK

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

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 www.ndt.net

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

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

ME 2856 ADVANCED I.C. ENGINEERING

L	T	P	C
3	0	0	3

GOAL

To expose the students to advanced concepts involved in improving the performance of IC engines.

OBJECTIVES

The course should enable the students to:

1. Understand the significance of various processes in I.C Engines.
2. Understand the combustion phenomena

OUTCOME

The students should be able to:

1. Compare the theoretical cycles with the actual one and distinguish the combustion process as applicable to SI and CI Engine.
2. Know about the advances taken place in IC engines and the important role played by engine management system in improving the performance.

UNIT I CYCLE ANALYSIS 9

Otto, Diesel, Dual, Stirling and Brayton cycles, comparison of air standard, fuel air and actual cycles, simple problems on the above topics.

UNIT II COMBUSTION 9

Combustion reactions and stoichiometry, heat of reaction, adiabatic flame temperature in constant pressure and constant volume systems, fuels for internal combustion engines and their properties, premixed and diffusion combustion as applicable to SI and CI engines, concepts of burning rate and flame velocity, fuel spray characteristics and combustion in diesel engines.

UNIT III COMBUSTION MODELLING 9

Basic concepts of engine simulation, governing equations, simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanic based models.

UNIT IV ADVANCES IN IC ENGINES 9

LHR engines, surface ignition concept and multi fuel engines, stratified charge and lean burn engines, performance and emission characteristics, merits and demerits.

UNIT V ELECTRONIC ENGINE MANAGEMENT 9

Computer control of SI & CI engines for better performance and low emissions, closed loop control of engine parameters of fuel injection and ignition

TOTAL : 45

TEXT BOOKS

1. Ganesan .V - IC Engines - Tata McGraw-Hill, 3rd Edition , 2010.
2. John B. Haywodd, Internal Combustion Engine Fundamentals, McGraw-Hill Automotive Technology Series ISBN 0-07-1000499-8, 1988.

REFERENCES

1. Ganesan .V - Computer Simulation of Spark Ignition Processes - Universities Process Ltd, Hyderabad - 1996.
2. Ganesan.V. - Computer Simulation of compression ignition engines - Orcent Longman -2000.
3. Richard Stone - Introduction to IC Engines- 3rd edition - Macmilan - 1999.

ME 2857 ENGINEERING DESIGN AND ANALYSIS

L	T	P	C
3	0	0	3

GOAL

To impart practical knowledge to the students about Computer Aided Design and Drawing of Machine Elements.

OBJECTIVES

The course should enable the students to:

1. Understand Design concept, selection of materials and manufacturing considerations in design.
2. Do Computer Aided Design concepts and applications
3. Design and Drawing of Fasteners and connection and Power transmission elements.Outcome

OUTCOME

The students should be able to:

1. Create design in Computer Aided Design concepts
2. Design various components of Machine Elements with the aid of various Software
1. Do Design and Drawing of Friction clutches and Brakes.

UNIT I ENGINEERING DESIGN AND COMPUTER AIDED DESIGN 9

The design process, concept, analysis, feasibility, Selection of materials and manufacturing considerations in design, Design with reference to repairs and reconditioning, specifically for working out at sea with its restrictions and limitations.

Role of computers - Computer Aided Engineering - Computer Aided Design - Design for Manufacturability - Computer Aided Manufacturing - Benefits of CAD.

UNIT II COMPUTER AIDED DESIGN AND FINITE ELEMENT ANALYSIS 9

Creation of Graphic Primitives - Graphical input techniques - Display transformation in 2-D and 3-D - Viewing transformation - Clipping - hidden line elimination - Mathematical formulation for graphics -

Curve generation techniques - Geometric Modelling - Wire frame, Surface and Solid models - CSG and B-REP Techniques - Features of Solid Modelling Packages - Parametric and features - Interfaces to drafting, Design Analysis - Exposure to FEA packages (for demonstration purpose only).

UNIT III TYPES OF LOADING AND DESIGN CRITERIA 9

Static loads, impact loads, repeated loads, variable and cyclic loads, combined and reversible loads. Stress concentration and design factors, fatigue strength, modes of failure, design stresses, factor of safety, theories of failure, wear, corrosion, design criteria, S-N curve Goodman and Soderberg equations.

UNIT IV JOINTS, SHAFTS AND COUPLINGS 9

Design of cotter joints, knuckle joints, bolted joints, welded joints, riveted joints. Design of shafts and couplings - Drafting using CAD packages

UNIT V BELTS, FRICTION CLUTCHES AND BRAKES 9

Design of Belt drives and hoists (Wire ropes), Multiple plate clutches, cone clutch, centrifugal clutch block brakes, internally expanding shoe brakes, external band brakes, differential band brakes - Solid modelling using CAD packages.

TOTAL: 45

TEXT BOOKS

1. Goutam Prohit and Goutam Ghosh, Machine Drawing with AutoCAD, 1st Impression, Dorling Kindersley(India) Pvt., Ltd., New Delhi,2007ist
2. J.E.Shigley, Mechanical Engineering Design, 1st metric edition, McGraw-Hill, New Delhi, 1986.
3. R.S.Khurmi and J.K.Gupta, Machine Design, 5th Edition, Eurasia publishing, New Delhi, 2005.
4. Sadhu Singh, Computer Aided Design and Manufacturing , Khanna Publishers, New Delhi, 1998.

REFERENCES

1. Abdulla Sharif, Machine Design, 3rd Edition, Dhanpat Roy & Sons, New Delhi,1995.
2. Pandya & Shaw, Elements Of Machine Design, 1st Edition, Charotar Publishing, Mumbai, 1997.
3. Groover and Zimmers, CAD / CAM : Computer Aided Design and Manufacturing, Prentice Hall of India, New Delhi, 1994.