B.S.ABDUR RAHMAN
U N I V E R S I T Y

B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)

(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

REGULATIONS (2009), CURRICULUM AND SYLLABUS
FOR
B.Tech. AUTOMOBILE ENGINEERING

(Updated upto June 2012)

REGULATIONS -2009 FOR B.TECH DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme

ii) **"Branch"** means specialization or discipline of B.Tech Degree Programme like Civil Engineering, Polymer Technology, etc.,

iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.,

iv) **"University"** means B.S.Abdur Rahman University.

v) **"Dean (Academic Courses)"** means Dean (Academic Courses) of B.S. Abdur Rahman University.

vi) **"Dean (Students)"** means Dean(Students) of B.S.Abdur Rahman University

vii) **"Controller of Exams"** means the Controller of Examination of B.S. Abdur Rahman University, who is responsible for conduct of examinations and declaration of results.

2.0 ADMISSION

2.1 a) Candidates for admission to the first semester of the eight semester B.Tech. degree programme shall be required to have passed the Higher Secondary Examination of the (10+2) curriculum (Academic stream) prescribed by the appropriate authority or any other examination of any university or authority accepted by the University as equivalent thereto.

2.1 b) Candidates for admission to the third semester of the eight semester B.Tech. programme under lateral entry scheme shall be required to have passed the Diploma examination in Engineering / Technology of the Department of Technical Education, Government of Tamilnadu or any other examination of any other authority accepted by the University as equivalent there to.

2.2 Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination prescribed by the University for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for plus two academic stream.

2.3 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the University from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. degree programmes in various branches of Engineering and Technology, each distributed over eight semesters with two semesters per academic year.

B.TECH. DEGREE PROGRAMMES:

Civil Engineering

Mechanical Engineering

Aeronautical Engineering

Automobile Engineering

Polymer Technology

Electrical and Electronics Engineering

Electronics and Communication Engineering

Electronics and Instrumentation Engineering

Computer Science and Engineering

Information Technology

4.0 STRUCTURE OF PROGRAMMES:

4.1 Every Programme will have a curriculum with syllabi consisting of theory and practical courses such as,

i) General core courses comprising mathematics, basic sciences, engineering sciences, humanities and engineering arts.

ii) Core courses of Engineering / Technology

iii) Elective courses for specialization in related fields.

iv) Workshop practice, laboratory work, industrial training, seminar presentation, project work, education tours, etc.,

v) NCC/NSS/NSO/YRC activities for character development.

4.2 Each course is normally assigned certain number of credits with one credit per lecture period per week, one credit per tutorial period per week, one credit for two - three periods of laboratory or practical or seminar or project work per week and one credit for four weeks of industrial training during semester vacations.

4.3 Each semester curriculum shall normally have a blend of lecture courses not exceeding six and practical courses not exceeding four.

4.4 For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. This minimum will lie between 175 and 185 credits, depending on the branch.

4.5 The medium of instruction, examinations and project report will be English, except for courses on languages other than English.

5.0 DURATION OF THE PROGRAMME

A student is ordinarily expected to complete the B.Tech. programme in eight semesters (six semesters in the case of lateral entry student), but in any case not more than 14 semesters (12 semesters in the case of lateral entry student). Each semester shall normally consist of around 90 working days or 450 working hours. Semester end examination will normally follow immediately after the last working day of the semester.

6.0 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the student will attach a certain number of students to a teacher of the Department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall advise the students and approve the courses to be taken by the students during registration and enrolment every semester.

7.0 COMMON COURSE COMMITTEE

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the course **Co-coordinator** shall be made by the Head of the Department / Dean (Academics), depending on whether all the teachers teaching the common course belong to the same department / different departments.

8.0 CLASS COMMITTEE

During first semester, a common Class Committee will be constituted for all branches by the Dean (Academic Courses). During other semesters, separate Class Committees will be constituted by the respective Head of the Department of the students.

8.1 The first semester Class Committee composition will be as follows:

i) Course Co-coordinators of all common courses.

ii) Teachers of all other individual courses.

iii) One male and one female first semester student of each branch of B.Tech, to be nominated by the Head of the Institution.

iv) All first semester Faculty Advisors as optional Special Invitees.

8.2 The composition of the class committee for each branch of B.Tech , from 2nd to 8th semester, will be as follows:

i) One senior faculty member preferably not teaching to the concerned class, appointed as Chairman by the Head of the Department

ii) Teachers of individual courses

iii) Two students, (preferably one male and one female) of the class per group of 30 students or part thereof, to be nominated by the Head of the Department, in consultation with the faculty advisors.

iv) All faculty advisors of the class

v) Teacher-in-charge of UG programme

vi) Head of the Department

8.3 The class committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of class commencement, in which the type of assessments, like test, assignment, assignment based test etc., will be decided for the first, second and third assessments. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

8.4 During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

8.5 The class committee, **excluding the student members and the invited members,** shall meet within 10 days from the last day of the end-semester examination to analyse the performance of the students in all the components of assessments and decide the grades secured by students in each course. The grades in a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

9.0 REGISTRATION AND ENROLMENT

9.1 Except for the first semester, every student shall register for the ensuing semester during a specified week before the end semester examination of the current semester. Every student shall submit a completed Registration form indicating the list of courses intended to be credited during the ensuing semester. Late registration with the approval of Dean (AC) along with a late fee will be permitted up to the last working day of the current semester.

9.2 From the second semester onwards, all students shall pay the prescribed fees for the semester on a specific day at the beginning of the semester confirming the registered courses. Late enrolment, with the approval of Head of the Institution along with a late fee, will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

9.3 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

9.4 A student should have registered for all preceding semesters before registering for a particular semester.

10.1 CHANGE OF A COURSE

A student can change a course within a period of 15 days from the commencement of the course, with the approval of the Dean(AC), on the recommendation of the Head of the Department of the student.

10.2 WITHDRAWAL FROM A COURSE

A student can withdraw from a course at any time before the second assessment for genuine reasons, with the approval of the Dean(AC), on the recommendation of the Head of the Department of the student.

11.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

A student can take a one time temporary break of study covering the current semester and/or next semester period with the approval of the Head of the Institution at any time before the start of third assessment of current semester, within the maximum period of 14 or 12 semesters as the case may be. If any students is debarred for want of attendance or suspended due to any act of indiscipline it will not be considered as break of study.

12.0 CREDIT LIMIT FOR ENROLMENT & MOVEMENT TO HIGHER SEMESTER

12.1 A student can enroll for a maximum of 30 credits during a semester period including redo courses.

12.2 The minimum credits required to move to 3rd semester B. Tech shall be 10 credits earned in the 1st semester. There will be no such minimum credit requirement to move to the remaining 4th to 8th semesters.

However, a student who secured "I" grade in all the courses of that semester is not eligible to move to the next higher semester.

12.3 A student who has not satisfied the NCC / NSS / NSO / YRC requirements (vide clause 19) will not be eligible to register for the fifth semester courses, even though he / she may satisfy all other requirements.

13.0 SUMMER TERM COURSES

13.1 A student can register for a maximum of three courses during summer term, If such courses are offered by the concerned department during the summer term. Fast-track summer courses of 30 periods for 3 credit courses and 40 periods for 4 credit courses will be offered for students with I grades. They may also opt to redo such courses during regular semesters with slotted time-tables.

13.2 The Head of the Department, in consultation with the department consultative committee and with the approval of the Head of the Institution may arrange for the conduct of a few courses during the summer term, depending on the availability of teachers during summer and subject to a specified minimum number of students registering for each of such courses.

13.3 However, in the case of students who have completed eighth semester, but having arrears in the earlier semesters in a maximum of two courses, summer courses may be offered, even if less than minimum students are registering for the course.

13.4 The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a summer term course or for substitute examination.

14.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

14.1 Every theory course shall have a total of four assessments during a semester as given below:

Assessment No.	Course coverage in weeks	Duration	Weightage of marks
Assessment 1	1 to 4	1.5 hours	50/3
Assessment 2	5 to 8	1.5 hours	50/3
Assessment 3	9 to 12	1.5 hours	50/3
Semester End Exam	1 to 18 (full course)	3 hours	50

14.2 The pattern of questions, for at least one of the tests, shall be the same as stipulated for the semester end examination by the University. Teachers handling courses are given the option to substitute with other suitable alternate type of evaluation approved by the class committee and the HOD. The details of such a scheme shall be announced to the students and informed to the Dean(AC) at the beginning of the semester.

14.3 Every practical course will have 75% weightage for laboratory assessment and 25% for semester end examination.

14.4 In the case of Industrial training, the student shall submit a report, which will be evaluated along with an oral examination by a committee of teachers, constituted by the Head of the department. A progress report from the industry will also be taken into account for evaluation.

14.5 In the case of project work, a committee of teachers constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva-voce) will be conducted as the end-semester examination, for which one external examiner, approved by the Controller of Examinations, will be included. The weightage for periodic review will be 50% and remaining 50% for the semester end examination.

14.6 Assessment of seminars and comprehension will be carried out by a committee of teachers constituted by the Head of the Department.

15.0 SUBSTITUTE EXAMINATIONS

15.1 A student who has missed, for genuine reasons, a maximum of two of the four assessments of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident or admission to a hospital due to illness, etc.

15.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean (AC) through the Head of the department within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the end-semester examinations.

16.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

16.1 All assessments of a course will be made on absolute marks basis. However, the Class Committee without the student members and the invited members shall meet within 10 days after the end-semester examinations and analyse the performance of students in all assessments of a course and award letter grade. The letter grades and the corresponding grade points are as follows:

Letter grade	Grade points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
I	--
W	--

"W" denotes withdrawal from the course

"I" denotes inadequate attendance in the course and hence prevention from writing semester end examination.

"U" denotes unsuccessful performance in the course.

16.2 A student who earns a minimum of five grade points in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student

16.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department and declared by the Controller of Examinations.

16.4 Within two weeks from the commencement of classes for the next semester, a student can apply for revaluation of his / her semester end examination answer paper in a course, on payment of a prescribed fee, through proper application to Dean(AC), who shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the teacher of the course and a senior member of faculty knowledgeable in that course. The committee shall meet within a week to revalue the answer paper and submit its report to the Controller of Examinations for consideration and decision

16.5 After results are declared, grade sheets shall be issued to each student, which will contain the following details. The list of courses enrolled during the semester including summer term courses, if any, and the grade scored, the Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of courses registered and the points corresponding to the grades scored in those courses,

taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses, if any.

If C_i, is the number of credits assigned by for i^{th} course and GP_i is the Grade Point obtained in the i^{th} course

$$GPA = \frac{\sum_i (Ci)(GPi)}{\sum_i Ci}$$

The Cumulative Grade Point Average CGPA shall be calculated in a similar manner, considering all the courses enrolled from first semester.

"I" and "W" grades will be excluded for calculating GPA .

"U", "I" and "W" grades will be excluded for calculating CGPA

16.6 After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA.

Classification	CGPA
First Class with Distinction	8.50 and above and passing all examinations in the first appearance and completing the programme within the normal 8 or 6(for lateral entry) semesters.
First Class	6.50 and above and completing the programme within a maximum of 10 or 8 (for lateral entry) semesters.
Second Class	All others

17.0 ATTENDANCE REQUIREMENT AND COURSE REPETITION

17.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% for genuine reasons like on medical grounds, representing the University in approved events etc., to become eligible to appear for the end-semester examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

17.2 The teacher of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Dean(AC) through the Head of the Department. There upon, the Dean (AC) shall announce, course-wise, the names of such students prevented from writing the semester end examination in each course.

17.3 A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I", or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

A student who is awarded **'U'** grade in a course will have the option of either to write semester end arrear exam at the end of the subsequent semesters, or to redo the course during summer term / regular semester.

If a student chooses to write the semester end arrear examination for the course, the grade will be calculated based on

either

continuous assessment marks already earned along with marks of the arrear examination

or

the arrear examination marks only,

whichever is higher.

The above procedure will be applicable for the First Year (First and Second Semester) and not for the remaining B.Tech Programmes.

From the Third Semester onwards the marks earned earlier in the continuous assessment for the course, will be used for grading along with the marks earned in the Semester end arrear examination for the course.

18.0 ELECTIVE CHOICE: OPTION TO DO PROJECT ALONE IN FINAL SEMESTER

18.1 Apart from the various elective courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department, during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

18.2 In the curriculum of eighth semester, along with the project work, if two elective courses alone are listed, then the Head of the Institution may permit

a student, as per approved guidelines, on the recommendation of the Head of the department, to do a full semester major industrial project work. In such a case, the above two elective courses or any other two elective courses in lieu thereof have to be enrolled during any semester including the summer, preceding or succeeding the project work, if offered.

19.0 PERSONALITY AND CHARACTER DEVELOPMENT

19.1 All students shall enroll, on admission, in any of the personality and character development programmes, NCC / NSS / NSO/YRC and undergo practical training.

- **National Cadet Corps (NCC)** will have to undergo specified number of parades.
- **National Service Scheme (NSS)** will have social service activities in and around Chennai.
- **National Sports Organisation (NSO)** will have sports, games, drills and physical exercises.
- **Youth Red Cross (YRC)** will have social service activities in and around Chennai.

19.2 Every student shall put in a minimum of 75% attendance in the practical training specified by the concerned authority. Normally this is to be completed during the first year. For valid reasons, the Dean(AC) may permit a student to complete this requirement in the second year. **However, before enrolling for fifth semester, a student should have completed the training and produced a certificate from the appropriate authority of NCC / NSS / NSO / YRC for having satisfactorily completed the prescribed training.**

20.0 DISCIPLINE

20.1 Every student is required to observe disciplined and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the Institution.

20.2 Any act of indiscipline of a student, reported to the Dean (Students), will be referred to a Discipline and Welfare Committee, nominated by the Vice-Chancellor, for taking appropriate action.

21.0 ELIGIBILITY FOR THE AWARD OF DEGREE

21.1 A student shall be declared to be eligible for the award of the B.Tech. degree provided the student has:

i) successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 14 semester (12 semesters for lateral entry) from the date of admission, including break of study.

ii) Completed the NCC/NSS/NSO/YRC requirements.

iii) no dues to the Institution, Library, Hostels, NCC, NSS, NSO, YRC and

iv) no disciplinary action pending against him/her.

21.2 The award of the degree must have been approved by the University.

22.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

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Curriculum & Syllabus for B.Tech. Automobile Engineering
(Eight Semesters / Full time)
CURRICULUM
SEMESTER I

CATAGORY	CODE NO	TITLE	L	T	P	C
THEORY	MA 101	Mathematics I	3	1	0	4
	EN 101	Technical English	2	2	0	4
	PH 101	Physics I	3	0	0	3
	CH 101	Chemistry I	3	0	0	3
	GE 101	Engineering Graphics	2	0	3	3
	GE 105	Fundamentals of Computing	3	0	0	3
PRACTICAL	PH 102	Physics Laboratory	0	0	2	1
	CH 102	Chemistry Laboratory	0	0	2	1
	GE 102	Basic Engineering Practices Laboratory	0	0	3	1
	GE 106	Computer Practice Lab	0	0	3	1

TC 24

SEMESTER II

CATAGORY	CODE NO	TITLE	L	T	P	C
THEORY	MA 102	Mathematics II	3	1	0	4
	PH103	Physics II	3	0	0	3
	CH 104	Chemistry II	3	0	0	3
	EE 185	Basic Electrical Engineering	3	0	0	3
	GE 107	Engineering Mechanics	3	1	0	4
	GE 201	Environmental Science & Engineering	3	0	0	3
PRACTICAL	EE 186	Electrical Engineering Laboratory	0	0	3	1
	ME 106	Computational Laboratory	0	0	3	1
	ME 107	Design Appreciation Lab	0	0	3	1
	EN 102	Communications Skill Lab I	0	0	3	1

TC 24

SEMESTER III

CATAGORY	CODE NO	TITLE	L	T	P	C
THEORY	MA 201	Mathematics III	3	1	0	4
	ME 202	Fluid Mechanics & Machinery	3	0	0	3
	EC 288	Electronics for Mechanical Systems	3	0	0	3
	AU 201	Manufacturing Technology	3	0	0	3
	AU 202	Applied Thermodynamics	3	1	0	4
	AU 203	MaterialsTechnology for Automobiles	3	0	0	3
PRACTICAL	ME 307	Materials Testing and Characterization Lab	0	0	3	1
	EC 289	Electronics and Microprocessor Lab	0	0	3	1
	AU 204	Manufacturing Technology Lab	0	0	3	1
	EN 201	Communication Skills Lab II	0	0	3	1

TC 24

SEMESTER IV

CATAGORY	CODE NO	TITLE	L	T	P	C
THEORY	MA 207	Statistics and Numerical Methods	3	1	0	4
	ME 209	Solid Mechanics	3	1	0	4
	ME 310	Metrology and Mechanical Measurements	3	0	0	3
	AU 205	Petrol Engines	3	0	0	3
	AU 206	Heat Transfer and Heat Exchanger	3	1	0	4
	AE 201	Mechanics of Machines	3	0	0	3
PRACTICAL	ME 314	Metrology & Measurements Lab	0	0	3	1
	ME 207	Machine Drawing Practice	0	0	3	1
	AU 207	Fluid Mechanics and Thermal Lab	0	0	3	1
	GE 202	Confidence Building and Behavioral Skills	0	0	2	1

TC 25

SEMESTER V

CATAGORY	CODE NO	TITLE	L	T	P	C
THEORY	AU 301	Design of Automotive Components - I	3	1	0	4
	AU 302	Diesel Engines	3	0	0	3
	AU 303	Automotive Chassis: Suspension, Steering and Wheels	3	0	0	3
	AU 304	Automotive Transmissions	3	1	0	4
	AU 305	Automotive Electrical and Electronics	3	0	0	3
	MS 382	Engineering Economics and Project Management	3	0	0	3
PRACTICAL	AU 306	Engine Components Laboratory	0	0	3	1
	AU 307	Four Wheeler Laboratory	0	0	3	1
	AU 308	Engine Testing and Emission Laboratory	0	0	2	1
	GE 301	Carrier Building and People Skills	0	0	2	1

TC 24

SEMESTER VI

CATAGORY	CODE NO	TITLE	L	T	P	C
THEORY	AU 309	Finite Element Methods for Automotive Applications	3	1	0	4
	AU 310	Noise, Vibration & Harshness	3	0	0	3
	AU 311	Engine Management System and Emission Control	3	0	0	3
	AU 312	Design of Automotive components - II	3	1	0	4
	AU 313	Two Wheelers and Three Wheelers	3	0	0	3
		Elective I	3	0	0	3
PRACTICAL	AU 314	Finite Element Analysis Lab for Automobile Applications	0	0	3	1
	AU 315	Two & Three Wheeler Laboratory	0	0	3	1
	AU 316	Automotive Electronics Laboratory	0	0	2	1
	AU 317	Structure & Vibration Analysis Lab	0	0	2	1

TC 24

SEMESTER VII

CATAGORY	CODE NO	TITLE	L	T	P	C
THEORY	AU 401	Automotive Manufacturing Technology	3	0	0	3
	AU 402	Vehicle Body Engineering	3	0	0	3
	AU 403	Modeling and Simulation of Vehicle Systems	3	1	0	4
	MS 481	Management Concepts and Industrial Relations	3	0	0	3
		Elective II	3	0	0	3
		Elective III	3	0	0	3
PRACTICAL	AU 405	Computer Aided Design and Manufacturing Lab	0	0	2	1
	AU 406	Vehicle Maintenance & Reconditioning Lab	0	0	3	1
	AU 407	Modeling and Simulation Lab	0	0	3	1
	AU 408	Minor Project	0	0	2	1

TC 23

SEMESTER VIII

CATAGORY	CODE NO	TITLE	L	T	P	C
THEORY	AU 409	Evaluation of Vehicle Performance	3	0	0	3
		Elective IV	3	0	0	3
		Elective V	3	0	0	3
PRACTICAL	AU 410	Comprehension	0	0	2	1
	AU 411	Project Work	0	0	12	6

TC 16

Total 184

LIST OF ELECTIVES

CATAGORY	CODE NO	TITLE	L	T	P	C
Electives	AUX 001	Automotive Safety Systems	3	0	0	3
	AUX 002	Fuels & Lubricants	3	0	0	3
	AUX 003	Electric & Hybrid Vehicles	3	0	0	3
	AUX 004	Lean and Six Sigma	3	0	0	3
	AUX 005	Alternative Energy for Automobile Application	3	0	0	3
	AUX 006	Advanced IC Engines	3	0	0	3
	AUX 007	Newer Materials for Automobiles	3	0	0	3
	AUX 008	Vehicle Comfort System & Ergonomics	3	0	0	3
	AUX 009	Intelligent Vehicle System	3	0	0	3
	AUX 010	Fuel Cell Technology	3	0	0	3
	AUX 011	Simulation of IC Engines	3	0	0	3
	AUX 012	Off Road Vehicles	3	0	0	3
	AUX 013	Surface Engineering & Heat Treatment	3	0	0	3
	AUX 014	Advanced Material Testing & Failure Analysis	3	0	0	3
	AUX 015	Tractor and Agricultural Machines	3	0	0	3
	AUX 016	Fleet Maintenance & Management	3	0	0	3
	ME 303	Applied Hydraulics and Pneumatics	3	0	0	3
	ME 311	Computer Aided Design and Manufacturing	3	0	0	3
	MEX 002	Total Quality Management	3	0	0	3
	MEX 008	Process Planning and Cost Estimation	3	0	0	3
	MEX 009	Micro Electro Mechanical Systems (MEMS)	3	0	0	3
	MEX 010	Design of Jigs, Fixtures and Press Tools	3	0	0	3
	MEX 012	Computational Fluid Dynamics and Heat Transfer	3	0	0	3
	MEX 022	Nano -Technology	3	0	0	3
	MEX 027	Professional Ethics in Engineering	3	0	0	3
	MEX 028	Optimization Techniques in Engineering	3	0	0	3
	MEX 029	Advanced Production Processes in Automotive Engineering	3	0	0	3

SYLLABUS
SEMESTER - I

MA 101	MATHEMATICS - I (Common to all branches)	L T P C 3 1 0 4

OBJECTIVES

- The course is aimed at developing the skills of engineering students in the basics of chosen topics of Mathematics that are imperative for effective understanding of engineering subjects.
- It also lays the foundation for learning further topics of Mathematics in higher semesters in a graded manner.
- The learners will be enabled to appreciate the important role of mathematical concepts in engineering applications.

UNIT I MATRICES **12**

Rank of a Matrix - Consistency of Linear System of Equations - Eigen Value Problems - Eigen Values and Eigen vectors of a real matrix, Engineering Applications - Characteristic Equations - Properties of Eigen Values and Eigen Vectors - Cayley Hamilton Theorem (without proof) Similarity Transformation (Concepts only) - Orthogonal matrices - orthogonal transformations of a symmetric matrix to diagonal form - reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY **12**

Direction cosines & ratios - angle between two lines - equations of a plane - equations of a straight line - coplanar lines - shortest distance between skew lines - sphere - tangent plane - plane section of a sphere - orthogonal spheres.

UNIT III GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS **12**

Curvature - Cartesian and polar coordinates - centre and radius of curvature - circle of curvature - involutes & evolutes - envelopes - properties of envelopes and evolutes, evolute as envelope of normals

UNIT IV FUNCTIONS OF SEVERAL VARIABLES **12**

Functions of two variables - partial derivatives - total differential - Taylor's expansion - maxima and minima - constrained maxima and minima - Lagrange's multiplier method - Jacobians - differentiation under integral sign.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS 12

Simultaneous first order linear equations with constant coefficients - Linear equations of second order with constant and variable coefficients - homogeneous equations of Euler type - equations reducible to homogeneous form - method of variation of parameters

L : 45, T : 15

TOTAL : 60

REFERENCES :

1. Kreyszig .E., "Advanced Engineering Mathematics " (8th edition), John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001
2. Kandasamy .P., Thilagavathy. K, and Gunavathy.K., "Engineering Mathematics" Volume I (Revised Edition) S.Chand & co , New Delhi, 2000
3. Rajasekaran.S., Chandrasekaran A., "Engineering Mathematics" Volume I (Revised Edition) Dhanam publishers, Chennai
4. Veerarajan.T., "Engineering Mathematics " Tata McGraw-Hill Publishing Co. New Delhi
5. Venkataraman. M.K., "Engineering Mathematics - First Year" National Publishing Company. Chennai.

EN101 **TECHNICAL ENGLISH** **L T P C**
2 2 0 3

(Common for all branches of first semester B.Tech. courses)

AIM

To encourage students to actively involve in participative learning of target language (English) and to help them acquire communication skills.

OBJECTIVES:

- To enable students to give instructions and directions.
- To enable students to receive messages.
- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate the reading habit and to develop effective reading skills
- To enable students write letters and reports effectively in formal and business situations.
- To help learners improve their vocabulary and to enable them to use words appropriately in different contexts.

UNIT I **12**

Focus on Language: Use of Suffixes, Change of word from one form to another, Tenses- simple present, present continuous, Interchange of voices, Impersonal passive form.

Reading: Skimming & Scanning using different texts.

Listening: Listening for general content.

Speaking: Pronunciation and accent.

Writing: Principles of writing, Paragraph writing, Definition, Description.

Suggested Activities: Changing the grammatical function of words using suffixes, Providing different contexts for using tenses, Changing voices(Active to Passive form)Rewriting in impersonal passive form.

UNIT II **12**

Focus on Language: Word formation with prefixes, Framing 'Wh'-questions-Yes-No questions and Question tags, Adjectives, Comparative Adjectives.

Reading: Scanning for specific information and making inferences.

Listening: Note-making

Writing: Comparison and Contrast, Bar charts

Speaking: Conversations- Eliciting information.

Suggested Activities: Changing the grammatical function of words using prefixes, Questions Yes/No types, Question tags, Using appropriate Comparative Adjectives, Role-play activities for eliciting information.

UNIT III **12**

Focus on Language: Tenses- simple past, past perfect, Phrasal verbs, SV concord, Rules of spelling, Compound nouns, Vocabulary.

Reading : Analysing and interpreting graphics information, Making inferences, Reading comprehension, Organization of information in a paragraph

Listening: Listening comprehension (multiple choice questions)

Writing: Use of discourse markers, Sequencing jumbled sentences, Letter to the editor, Letter of invitation.

Speaking: Debates.

Suggested activities: Providing context for tenses, Fill in the blanks with suitable phrasal verbs, Correction of sentences, Editing, Expansion of Compound nouns, Multiple choice, Gap filling, Conversations, Persuasive speaking, Drawing inferences.

UNIT IV **12**

Focus on Language: Use of imperatives, Prepositions, Adverbs, Use of modals, Tenses- Simple future tense and 'If' conditionals

Reading: Extensive reading- reading general texts.

Listening: Intensive listening, Guessing the main idea based on the contextual meaning, multiple choice,

Writing: Cause and effect, Purpose and function expressions, Instructions and Recommendations

Speaking: Future plans,(career topic oriented).

Suggested activities: Rewriting sentences using imperatives , fill in the blanks with suitable prepositions, adverbs, use of modal verbs in sentences , Using tenses in different contexts, Use of 'If' conditionals, Giving cause & effect statements to be linked with expressions like as, since, because, etc, using expressions of 'purpose &function' &linking sentences, Using expressions related to recommendations & writing recommendations. Students may be asked to read the book suggested for extra reading and submit assignments. Assignments can be in the form of review, criticism, appreciation etc.

UNIT V **12**

Focus on Language: Numerical adjectives, Using vocabulary in different contexts.

Reading - Reading between the lines understanding implied meanings in the context.

Listening -Listening for specific information, taking messages - memos

Writing- Business letters - quotations, placing an order, complaint, check list.

Speaking - Group Discussion - Problems and Solutions

Suggested activities: Rewriting sentences as numerical adjectives, Technical vocabulary, Identifying an issue and discussing the solution, Writing formal letters - Calling for quotations, Placing an order, Complaint- Writing recommendations, Instructions- Preparing a check list, Listening to conversations & taking down messages.

Total 60

TEXT BOOK :

1. Department of Humanities & Social Sciences, Anna University, " English For Engineers & Technologists" combined edition (volumes 1 & 2).

REFERENCES :

1. Andrea J. Rutherford, 'Basic Communication Skills for Technology' second edition. Pearson Education.

2. P.K.Dutt, G. Rajeevan and C.L.N. Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.

3. Krishna Mohan and Meera Banerjee, ' Developng Comminication Skills', Macmillan India Ltd., (reprinted 1994-2007)

EXTENSIVE READING

1. A.P.J. Abdul Kalam with Arun Tiwari, ' Wings of Fire' An Autobiography. University Press (India) Pvt. Ltd. 1999, 30th impression 2007.

Assessment

I Writing - 50

II Listening - 50

Assessment to be done by the Department

III Writing - 50

IV End semester - Writing - 50

PH 101	PHYSICS-I (Common to all branches)	L T P C 3 0 0 3

Aim:

1. To introduce the basic physics concepts relevant to different branches of Engineering and Technology.
2. To enhance theoretical and modern technological aspects in physics.
3. To enable the students to correlate theoretical principles with application oriented studies.
4. To introduce the fundamental of science for engineering applications.

Objectives:

At the end of the course, the students would be exposed to

- Basic understanding of crystal physics, theory of polarization, photo elasticity, ultrasonics
- To impart fundamental knowledge in various engineering subjects and applications.
- Structure identification of engineering materials.
- Non Destructive techniques
- Application of quantum physics to optical and electrical phenomena
- Application of lasers in Engineering.
- Understanding of fiber optics for applications in communication

UNIT I CRYSTAL PHYSICS **9**

Introduction - Space lattice - unit cell - Bravais lattices - Miller Indices for cubic crystals - Inter planar spacing in cubic lattice - simple crystal structures - SC, BCC, FCC and HCP structures - atomic radius, coordination number, Packing factor calculation - crystal imperfections - point, line and surface defects - Burger vector.

UNIT II QUANTUM PHYSICS **9**

Black body radiation - Planck's theory of radiation - deduction of Wien's displacement law and Rayleigh - Jeans law from Planck's theory - Compton effect - Theory and experimental verification - Dual nature of matter - De Broglie's wavelength- physical significance of wave function - Schroedinger

wave equation - time independent and time dependent wave equation - particle in one dimensional box.

UNIT III WAVE OPTICS **9**

Polarization - double refraction - Theory of plane polarized,circularly polarized and elliptically polarized light - Quarter wave plate, Half wave plate - production and detection of plane, circularly and elliptically polarized lights - photoelasticity - photo elastic effect - stress optic law - effect of stressed model in a plane polariscope - isoclinics and isochromatic fringes -photo elastic bench.

UNIT IV ULTRSONICS AND NDT **9**

Ultrasonics - production - magnetostriction and piezo electric methods - properties of ultrasonic waves - Detection of ultrasonic waves - Applications - Acoustical grating - SONAR - depth of sea - measurement of velocity of blood flow - Non Destructive Testing (NDT) methods - Liquid penetrant method - ultrasonic flaw detector - A,B and C scan displays - X - ray radiography and fluoroscopy.

UNIT V LASER AND FIBRE OPTICS **9**

Characteristics of laser light - Einstein's A & B coefficients (derivation) - Nd:YAG laser - He -Ne laser - CO_2 laser - homo and hetero junction semiconductor lasers - applications - material processing and holography (construction and reconstruction of hologram) - Optical fibre - principle of propagation of light in optical fibers - Numerical aperture and acceptance angle - single and multimode fibres - step index and graded index fibres - applications - fibre optic communication system (block diagram only)- fibre optic sensors (displacement and pressure sensors - qualitative).

TEXT BOOKS:

1. Avadhanulu M.N., Engineering Physics, 1st Edition, S.Chand & Company Ltd., New Delhi, 2007.

2. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.

REFERENCE:

1. Uma Mukherji, Engineering Physics, Narosa Publishing House, New Delhi, 2007.

CH 101	CHEMISTRY- I	L	T	P	C
	(Common to all branches)	3	0	0	3

OBJECTIVES :

To make the student conversant with the

- Principles of water characterization and treatment of potable and industrial purposes.
- Different types of Engineering materials, their properties and uses.
- Concept of Electrochemistry and its principles.
- Basic principles in Fuels and combustion
- Applications of Instrumental analysis

UNIT I WATER TECHNOLOGY **9**

Introduction - Impurities present in water - Hardness, Types of Hardness, Estimation of Hardness (EDTA method) (Problems) - Alkalinity, Estimation of Alkalinity -Disadvantages of hard water in industries - Conditioning methods: external treatment method: Ion exchange methods - internal treatment: colloidal, phosphate, calgon, carbonate methods - drinking water standards (BIS) - treatment of domestic water: screening, sedimentation, coagulation, filtration, disinfection: by chlorination, UV treatment, ozonization - desalination and reverse osmosis (principle only).

UNIT II ENGINEERING MATERIALS **9**

Abrasives: Moh's scale of hardness - natural abrasives: diamond, corundum, emery, garnets and quartz - artificial abrasives: silicon carbide, boron carbide

Refractories: characteristics, classification - acid, basic and natural refractories, properties - refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling - general method of manufacture of refractories, properties and uses of high alumina bricks, magnesite and zirconia bricks

Lubricants and lubrication - functions - classification with examples - properties: viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point - greases: calcium, sodium and lithium based - solid lubricants - graphite and molybdenumdisulphide.

UNIT III ELECTRO CHEMISTRY **9**

Galvanic cells - reversible and irreversible cells - EMF and its measurement - standard and single electrode potential - electrochemical series - Types of

electrodes: metal-metal ion electrode, gas electrode, metal-metal insoluble salt electrode, standard hydrogen electrodes, calomel electrodes, ion selective electrode: glass electrode and determination of pH using glass electrode - Nernst equation, application and problems - Kohlrausch law of independent migration of ions, polarization, overvoltage, decomposition potential (statements only) - Conductometric and potentiometric titrations.

UNIT IV FUELS AND COMBUSTION 9

Classification of fuels - Solid Fuel: coal varieties - analysis of coal, proximate analysis and significances (moisture, volatile mater, ash content & carbon content) - ultimate analysis (only principle) - coke manufacture by Otto-Hoffman by product coke oven method - characteristics of metallurgical coke.

Liquid Fuel: petroleum - refining - fractions - composition and uses - cracking: thermal and catalytic (fixed bed & fluidized bed) - synthetic petrol: Fischer-Tropsch and Bergius process - knocking: octane number, improvement of antiknock characteristics - diesel engine fuel: cetane number.

Gaseous fuels - Compressed natural gas and LPG.

Combustion: gross and net calorific values, theoretical calculation of calorific values (Dulong's formula), calculation of minimum requirement of air (simple calculations) - flue gas analysis by Orsat apparatus.

UNIT V SPECTROSCOPY 9

Electromagnetic spectrum - absorption of radiation - electronic, vibrational, translational and rotational - intensities of spectral lines - Beer-Lambert's Law (Problems) - Colorimetric analysis: estimation of concentration of a solution - Flame photometry: theory, instrumentation (block diagram only) and application - UV-Visible spectroscopy: Principles, instrumentation (block diagram only) and simple applications - IR spectroscopy - simple applications only.

TOTAL: 45

TEXT BOOKS:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai & Sons, New Delhi. 2001.

2. Puri B.R., Sharma L.R. and Madan S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co., Jalandhar, 2000.

REFERENCES:

1. Bahl B.S., Tuli G.D., and Arun Bahl, Essentials of Physical Chemistry, S. Chand & Company Ltd., New Delhi, 2004.

2. Kuriacose J.C. & Rajaram J, Chemistry in Engineering & Technology, Vol. 1, Tata McGraw-Hill publishing company, New Delhi, 1996.

GE 101	ENGINEERING GRAPHICS (Common to All Branches)	L	T	P	C
		2	0	3	3

OBJECTIVES

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers.
- To provide an exposure to the appropriate standards for technical drawings.
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, pictorial views and free hand drawing.
- To introduce computerized drafting.

BASICS **3**

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

UNIT I CURVES AND ORTHOGRAPHIC PROJECTION **9**

Conic sections : ellipse, parabola, hyperbola

Special curves : cycloid, epicycloid, hypocycloid, involutes, helix

Orthographic projection - first angle, third angle projections, principle, free hand sketching of 3D to 2D as per first angle projection.

UNIT II PROJECTION OF POINTS, STRAIGHT LINES AND PLANE SURFACES **12**

Orthographic projection of points, straight lines in first quadrant - true length and true inclinations - traces. Projection of plane lamina in first quadrant.

UNIT III PROJECTION OF SOLIDS **12**

Projection of solids : prism, pyramid, cone, cylinder - auxiliary projection.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **12**

Section of solids : prism, pyramid, cone, cylinder, and sphere - sectional view - true shape. Solids in simple position and cutting plane inclined to one reference plane only. Development of surfaces of truncated solids : prism, pyramid, cone cylinder - frustum of cone and pyramid.

UNIT V PICTORIAL PROJECTIONS **12**

Isometric scale - Isometric projection & Isometric view of prism, pyramid, cylinder, cone, frustums and truncated solids. Perspective projection of prism, pyramid, cylinder, frustums - Visual ray method and Vanishing point method. Commands and demonstration of Drafting packages.

TOTAL : 60

TEXT BOOK:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 46th Edtion, (2003)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai, (2006).
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai, (2008).

GE 105	FUNDAMENTALS OF COMPUTING (Common to all branches)	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the major components of a computer system
- To learn the basics of programming in C
- To know the correct and efficient ways of solving problems
- To learn the use office automation tools

UNIT I BASICS OF COMPUTER AND INFORMATION TECHNOLOGY 8

Digital Computer fundamentals - Block diagram of a computer-Component of a computer system - Hardware and software definitions - Categories of software - Applications of computers - Role of Information technology -Internet Services Types and generation of programming languages - algorithm - flow chart - pseudo code - Top down approach - refinement - one-in one-out control structures - Development of solutions for simple problems using flow charts and pseudo code.

UNIT II BASIC ELEMENTS OF C 9

Introduction to C - Lexical elements of C - types - their representation - Operators and Expressions - Operator precedence - and associatively of operators-Input and Output functions - simple computational problems.

UNIT III DECISION MAKING 10

Control statements - branching, looping, nested control structures, switch, break, continue, goto statements - Problems using control structures.

Functions and Program structures:

Prototypes and Functions - Declaring defining and accessing functions - Parameter passing methods -storage classes -auto, extern, static, and register- Library functions. - Programs using functions - recursion.

UNIT IV ARRAYS 8

Defining and processing arrays - Passing arrays to functions - Multi - dimensional arrays - strings and basic operations on strings - enumerated data types - Programs using simple sorting, searching.

UNIT V POINTERS **10**

Pointer concept - Declarations - Accessing variable through pointer-Structures - User defined data types

File handling

File pointer - Opening and closing of file - Creating, Processing and Updation on files - simple file handling programs.

TOTAL : 45

TEXT BOOK

1. Jeri R. Hanly and Elliot B. Koffman , "Problem Solving and Program Design in C", Fifth Edition, Pearson Education (2009)

REFERENCES

1. Brian W. Kernighan and Dennis M. Ritchie, "The C programming Language", Pearson Education Inc. (2005).
2. Behrouz A. ForouZan and Richard. F. Gilberg, "A structured Programming Approach using C", II Edition, Brooks-Cole Thomson Learning Publications,2001.
3. V Rajaraman, "Computer Basics and C Programming", PHI (2008)
4. E.Balagurusamy,"Computing Fundamentals and C Programming",Tata McGraw Hill Publishing Company Ltd, New Delhi, 2008.

CH 102	CHEMISTRY LABORATORY (Common to all branches)	L T P C 0 0 2 1

OBJECTIVES

- To develop scientific attitude among the students.
- To develop skill to measure, differentiate and analyze the best results.

I. WEIGHING AND PREPARATION OF STANDARD SOLUTIONS

1. Preparation of molar and normal solutions of the following substances - oxalic acid, sodium carbonate, sodium hydroxide, hydrochloric acid.
2. Preparation of buffer solutions: borate buffer, phosphate buffer using Henderson equation.

II. WATER ANALYSIS

3. Determination of total hardness, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content by Winkler's method.
5. Determination of alkalinity in a water sample.
6. Determination of chloride content of water sample by argentometric method.

III. pH

7. To find out the strength of given hydrochloric acid by sodium hydroxide.

IV. CONDUCTOMETRY

8. Conductometric titration of mixture of acids.
9. Conductometric precipitation titration using BaCl2 - Na2SO4.

V. POTENTIOMETRY

10. Redox titration - Iron Vs. dichromate.

VI. SPECTROPHOTOMETRY

11. To determine the iron content of an unknown solution (1,10-phenanthroline / thiocyanate method)

VII. FLAME PHOTOMETRY

12. To determine sodium and potassium in water

VIII VISCOMETRY

13. Determination of molecular weight of a polymer.

REFERENCES :

1. A Text of Quantitative Inorganic Analysis, A.I.Vogel, ELBS, London.
2. Experiments in Physical Chemistry, D.P. Shoemaker and C.W. Garland, McGraw-Hill, London.

PH 102	PHYSICS LABORATORY (Common to all branches)	L T P C 0 0 2 1

OBJECTIVES

- The students after learning experiements, they will acquire the sound knowledge of practical that is applicable to real time problems in Optics, Heat, Properties of matter and Magnetism.
- Studetns are capable of applying these concepts in Engineering problems to get the solution.

LIST OF EXPERIMENTS:

1. Torsional Pendulum - Determination of rigidity modulus of wire and moment of inertia of disc.
2. Non- Uniform Bending - Young modulus determination
3. Viscosity - Determination of co-efficient of Viscosity of liquid by Poiseuilles flow.
4. Lee' disc - Determination of thermal conductivity of a bad conductor.
5. Air wedge - Determination of thickness of a thin wire.
6. Spectrometer - Determination of wavelength of Hg source using Grating
7. (i) Determination of wavelength of Laser using Grating

   (ii) Particle size determination

   (iii) Determination of Numerical Aperture and Acceptance angle of an optical Fiber.
8. Ultrasonic Interferometer - Velocity of Ultrasonic waves in a liquid and compressibility of the liquid.
9. Band gap determination of a semiconductor.
10. Determination of hysteresis loss in a ferromagnetic material.

GE 102 BASIC ENGINEERING PRACTICE LABORATORY (Common to All Braches) **L T P C 0 0 3 1**

OBJECTIVES

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits.
- To have an understanding on the use of various tools, instruments and methods.
- To enable the students to appreciate the practical difficulties and safety issues.

UNIT I CIVIL ENGINEERING PRACTICE **9**

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints

UNIT II MECHANICAL ENGINEERING PRACTICE **12**

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mould preparation for simple component

UNIT III ELECTRICAL ENGINEERING PRACTICE **12**

1. Basic house hold wiring using switches, fuse, indicator - lamp
2. Study of Tube light wiring, iron box, fan with regulator, emergency lamp and stair case light wiring

UNIT IV ELECTRONIC ENGINEERING PRACTICE **12**

1. Soldering simple electronic circuits and checking continuity
2. Assembling and testing of telephone circuit, FM radio on a small PCB

TOTAL : 45

GE 106	COMPUTER PRACTICE LAB (Common to all branches)	L T P C 0 0 3 1

OBJECTIVES

- To give practical exposure in the office automation tools
- To practice the basics of programming in C
- To practice the correct and effecient ways of solving problems

LIST OF EXPERIMENTS

UNIT I WORD PROCESSING AND SPREAD SHEET

1. Word Processing

a. Document creation, Text formatting, Searching.

b. Table creation, Table formatting.

2 Spread Sheet

a. Formula - formula editor.

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

c. inclusion of Picture and graphics

d. Sorting and Import / Export features.

UNIT II C PROGRAMMING

3. Data types, Expression Evaluation, Condition Statements.

4. Functions, Recursion and parameter passing mechanisms.

5. Arrays

UNIT III

6. Structures and Unions

7. Pointers and Functions

8. File Processing

9. Dynamic allocation, Linked List

SEMESTER - II

MA 102	MATHEMATICS - II	L	T	P	C
	(Common to all branches except CSE & IT)	3	1	0	4

OBJECTIVES

- To train the students in additional areas of Engineering Mathematics, necessary for grooming them into successful engineers.
- To learn the tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.

UNIT I MULTIPLE INTEGRALS 12

Double integration - Cartesian and Polar coordinates - change of order of integration - area as a double integral - triple integration in Cartesian coordinates - change of variables between Cartesian and polar coordinates and cylindrical, spherical polar coordinates.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl - line, surface and volume integrals - Green's, Gauss Divergence and Stoke's theorems - verification and evaluation of integrals using them.

UNIT III ANALYTIC FUNCTIONS 12

Function of a complex variable - Analytic function - necessary conditions - Cauchy-Riemann equations in Cartesian coordinates - sufficient condition - properties of analytic function - determination of harmonic conjugate by Milne-Thomson method - conformal mapping (w= a+z, az, 1/z,) and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Statement and application of Cauchy's theorem - Cauchy's integral formula - Taylor and Laurent expansion - singularities classification - residues - Cauchy's residue's theorem - contour integration - unit circle and semi circular contours

UNIT V LAPLACE TRANSFORM 12

Laplace transform - sufficient condition - transforms of elementary functions-basic properties- inverse transforms -derivatives and integral of transforms-transforms of derivatives and integrals- convolution theorem - transform of

periodic functions - application to solution of linear ordinary differential equations - second order with constant coefficients, Simultaneous equations.

L : 45, T : 15

TOTAL : 60

REFERENCES :

1. Kreyszig.E., " Advanced Engineering Mathematics " (8th edition), John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001
2. Kandasamy,p., Thilagavathy.k, and Gunavathy.k., "Engineering Mathematics" Volume II (Revised Edition) S.Chand &co , New Delhi, 2000
3. Rajasekaran.S., Chandrasekaran A., "Engineering Mathematics" Volume II (Revised Edition) Dhanam publishers, Chennai
4. Veerarajan.T., "Engineering Mathematics " Tata McGraw - Hill Publishing Co. New Delhi
5. Venkataraman. M.K. "Engineering Mathematics - First Year" National Publishing Company. Chennai.

PH 103	PHYSICS II	L	T	P	C
		3	0	0	3

(Common to Mechanical, Aeronautical, Automobile, EEE, ICE, Civil and Polymer)

Aim:

1. To enhance theoretical and modern technological aspects in physics
2. To enable the students to correlate theoretical principles with application oriented studies
3. To introduce the fundamental of science for engineering applications

OBJECTIVES:

At the end of the course, the students would be exposed to basic understanding of

- Theory of conducting materials, conductivities and their measurement and applications in engineering field.
- Semiconducting materials and their types, carrier concentration in intrinsic & extrinisic semiconductors and their applications.
- Dielectric materials and their types, dielectric loss, applications of dielectrics in engineering fields.
- Superconducting materials, types, properties and their applications in various engineering fields and also basic knowledge about various new engineering materials.
- Thermal conductivity and its application.

UNIT I CONDUCTING MATERIALS 9

Classical free electron theory of metals - Electrical conductivity and thermal conductivity - Widemann Franz law(derivation) - Lorentz number - Drawbacks of classical theory - Quantum free electron theory and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals (derivation) - Fermi energy - Classification of solids into conductors, semiconductors and insulators on the basis of Band theory (qualitative).

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductors - Elemental and compound semiconductors - Drift current and diffusion current - carrier concentration (derivation) - Fermi energy

- Variation of Fermi energy level with temperature - mobility and electrical conductivity - band gap determination - Extrinsic semiconductors - carrier concentration in n-type and p- type semiconductors (derivation) Energy band diagram of n-type and p-type semiconductor (derivation) - Variation of Fermi level with temperature and Impurity concentration - Variation of Electrical conductivity with temperature - Hall effect - Experiment and applications of Hall effect.

UNIT III DIELECTRIC MATERIALS 9

[Dielectric constant (Er) - Electric susceptibility (X) - Different types of dielectric polarization: electronic , ionic, orientational and space charge polarization - frequency and temperature dependence of polarization - Internal field and deduction of Clausius - Mossoti's equation (derivation) - Dielectric loss - Types of dielectric breakdown - uses of dielectric materials (Capacitor and transformer)

UNIT IV SUPERCONDUCTING MATERIALS & NEW ENGINEERING MATERIALS 9

Superconductivity - Meissner effect - Critical magnetic field - type I and type II superconductors - High temperature superconductors - Applications of superconductors: SQUID and magnetic levitation - Nonlinear optics - Harmonic generation - Optical mixing - Optical phase conjugation - Solitons - Metallic glasses - properties and application - Shape Memory Alloys - properties and applications - Nano phase materials - properties and applications.

UNIT V THERMAL PHYSICS 9

Mode of heat transfer, coefficient of Thermal conductivity, Thermal diffusivity, Rectilinear flow of heat along a bar (derivation) - Radial flow of heat, spherical shell method (derivation) - determination of thermal conductivity of Rubber and powder materials - conduction through compound media - Thermal insulation in the buildings - Practical application of heat conduction and convection - conductivity of the earth' crust and age of the earth - Ventilation - Radiators - Central heating - Removal of generated heat in automobiles - gas filled electric lamps.

TOTAL : 45

TEXT BOOKS:

1. Avadhanulu M.N., Engineering Physics, 1st Edition, S.Chand & Company Ltd, New Delhi, 2007.

2. Gaur R.K.and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.

3. Brijlal and Subrahmanyam, N., Heat & Thermodynamics, New edition, S. Chand & Company Ltd., New Delhi, 2007.

REFERENCES:

1. Charles Kittel, Introduction to solid state physics, 7th Edition, John Wiley & sons(ASIA) Pvt., Ltd.

2. Uma Mukherji, Engineering Physics, Narosa Publishing House, New Delhi.

CH 104 CHEMISTRY II L T P C
(Mechanical, Aeronautical and Automobile Engineering) 3 0 0 3

Objectives

- To make the student conversant with the
- Different types of corrosion and their inhibition.
- Various energy sources and their applications.
- Principles of Photochemistry and liquid crystals.
- Different types of polymers and their applications.

UNIT I CORROSION AND CORROSION INHIBITION 9

Corrosion - causes of corrosion - principles of chemical corrosion - Pilling - Bedworth rule - principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion - types of corrosion: galvanic, differential aeration, stress, soil (microbial), pitting and water line - corrosion control: cathodic protection - sacrificial anode - selection of materials and proper designing - corrosion inhibitors.

UNIT II PROTECTIVE COATINGS 9

Introduction- Treatment of metal surface- Inorganic coatings - Metallic Coatings- Hot dipping, Cladding, Cementation, Electroplating, Electroless plating- Electro Chemical Machining- Electro winning - Chemical conversion coatings- Chromate, phosphate, oxide coating- Anodizing- Organic Coatings- Paints - constituents - functions - mechanism of drying - varnishes and lacquers - special paints - fire retardant, water repellant, temperature indicating and luminous paints.

UNIT III ENERGY SOURCES AND ENERGY STORING DEVICES 9

Nuclear fission process - characteristics of nuclear fission - chain reactions - nuclear energy - nuclear reactors - light water nuclear power plant.

Batteries - introduction - primary and secondary batteries - dry cells - alkaline batteries, lead acid storage cell, nickel - cadmium cell, lithium battery - fuel cell - hydrogen - oxygen fuel cell - photogalvanic cell and dye sensitized solar cell.

UNIT IV PHASE RULE AND PHYSICAL METALLURGY 9

Phase rule - statements and explanation of the terms involved - condensed

phase rule - construction of phase diagram - thermal analysis - simple eutectic system (Ag-Pb system only) - applications of phase rule - physical metallurgy - powder metallurgy - preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - uses, advantages and limitations of powder metallurgy.

UNIT V POLYMER CHEMISTRY 9

Monomers - functionality - polymer - degree of polymerization - classification based on source and applications - effect of polymer structure on properties - addition, condensation, co-polymerization and co-ordination polymerization - mechanism of addition - polymerization (free radical mechanism) - thermosetting and thermoplastics resins - preparation, properties and applications of polythene, polycarbonates, TEFLON, polyvinyl chloride, epoxy resins - vulcanization of rubber - rubber blended plastics - laminated plastics - laminated glass - thermocole.

TOTAL: 45

TEXT BOOKS:

1. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi, Edition 2002.
2. Dara S.S., A text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi, 2003.

REFERENCES

1. Christopher, Brett M.A., Electrochemistry Principles, Methods and applications, Oxford Unit Press, 1993.
2. Raymond A., Higgins, Engineering Metallurgy Part-1, Applied Physical Metallurgy, ELBS, 1983.

EE 185 BASIC ELECTRICAL ENGINEERING L T P C
3 0 0 3

(Common for Mechanical, Aeronautical & Automobile Engineering)

AIM

To expose the students to the basic concept of circuits, operation & control of machines

OBJECTIVES

- To study Kirchhoff's a laws & the phasor representation, complex power and three phase curcuits and do simple problems.
- To study qualitatively about the construction and principle of operation of D.C. machines and to do simple problems.
- To study qualitatively about the construction and principle of operation of transofrmers and three phase induction motors and to do simple problems.
- To study qualitatively the time responses of 1st and 2nd order system.
- To study qualitatively the Thyristor - Operation and its usage in-Speed control of motors.

UNIT I ELECTRIC CIRCUITS 9

Introduction to DC circuits: ohm's law, Kirchhoff's laws, resistance connections, defining terms. Introduction to AC circuits: AC, representation techniques, defining terms, series and parallel circuits, 3 phase circuits. Simple problems.

UNIT II DC MACHINES 9

Construction -types- generator- characteristics- motors- characteristics- starting and speed control- testing(only load test)- curves & efficiency.

UNIT III AC MACHINES 9

Transformers: construction, types, principle of operation, behavior of load, equivalent circuit, voltage regulation of load, equivalent circuit, voltage regulation, efficiency. Three phase Induction motor: construction, types, characteristics, speed control, starting methods. Simple problems.

UNIT IV INTRODUCTION TO CONTROL SYSTEMS 9

Differential equation of physical systems, time response of 1st and 2nd order systems, errors, state variable analysis- Components- servo motors- stepper motors- control of motors-simple problems.

UNIT V SOLID STATE DRIVES **9**

Introduction to Thyristor-Types-Operation -Speed control of motors-SCR drives-PWM drives -Variable Voltage Variable Frequency drives.

REFERENCES:

1. Edward Hughes; Electrical and Electronics Technology, Pearson India, 9th Edition, 2007.

2. Cotton.H; Electrical Technology, Pitman

Total : 45 Hrs

GE 107	ENGINEERING MECHANICS (Common to all Branches)	L	T	P	C
		3	1	0	4

OBJECTIVES

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving.
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium.
- To give on exposure on inertial properties of surfaces and solids.
- To provide an understanding on the concept of work energy principles, friction, kinematics of motion and their relationship.

UNIT I BASICS AND 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 Algebra and its Physical relevance in Mechanics- 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 - 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 PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes - First moment of area and the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - second and product moments of plane area - Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia

Mass moment of inertia - Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle - Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Review of laws of motion - Newton's law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

Introduction to vibrations - Single degree of freedom systems - with and without damping

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

L : 45, T : 15

TOTAL: 60

TEXT BOOK :

1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.

REFERENCES :

1. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000

2. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson Education Asia Pvt. Ltd., 2003

GE 201 ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**

3 0 0 3

OBJECTIVES

To make the student to

- Create awareness on social issues and various environmental pollution aspects and issues.
- Realize that environmental problems involve social, ethical, political and economic issues, not just scientific issues.
- Understand what is meant by an ecosystem approach to environmental problem solving.
- Recognize that different geographic regions have somewhat different environmental problems, but the process for resolving them is the same and involves compromise.
- Understand why environmental problems are complex and interrelated.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Definition, scope and importance, Need for public awareness.

Natural resources and associated problems - Uses, over exploitation and environmental impacts of (a) Forest resources, (b) Water resources, (c) Mineral resources, (d) Food resources, (e) Land resources, (f) Energy resources - Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 9

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 following ecosystem (a) Terrestrial ecosystems (Forest, Grassland, Desert), (b) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT III BIODIVERSITY AND HUMAN POPULATION 9

Introduction - Definition, genetic, species and ecosystem diversity; Bio-geographical 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.

Population growth, variation among nations; Population explosion; Family Welfare Programme

UNIT IV ENVIRONMENTAL POLLUTION AND ITS CONTROL 9

Definition, Cause, 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; Disaster management: floods, earthquake, cyclone and landslides.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT 9

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; Environmental ethics: Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; 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.

Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health.

L : 45, T : 15

TOTAL: 60

TEXT BOOKS :

1. Erach Bharucha, Text Book for Environmental Studies - Environmental Studies For Undergraduate Courses, University Grants Commission, New Delhi and Bharati Vidyapeeth Institute of Environmental Education and Research, Pune, 2004.

2. Purohit S.S., Shammi Q.J., Agarwal A.K., A Text Book of Environmental Sciences, Student Edition of India, 2004.

REFERENCES :

1. Clair N. Sawyer, Perry L. McCarthy and Gene F. Parkin, Chemistry for Environmental Engineering and Science, 5th Edition, Tata McGraw-Hill Education Pvt. Ltd, India, 2011.

2. Surinder Deswal and Anupama Deswal, A Basic Course in Environmental Studies, Dhanpat Rai & Co. (P) Ltd., India, 2005.

EE 186	ELECTRICAL ENGINEERING LAB	L	T	P	C
		0	0	3	1

(Common for Mechanical, Aeronautical & Automobile Engineering)

OBJECTIVES

- To study the performance of various types of generators and motors by conducting load test.

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff's law.
2. Study of R.L.C series circuit.
3. O.C.C of a DC generator.
4. Load test on D.C generator.
5. Load test on D.C motors
6. Speed control of D.C shunt motors.
7. Load characteristics of a single phase transformer.
8. Load test on 3 phase induction motor.
9. Transfer function of separately excited DC generator
10. Transfer function of armature and fixed controlled DC motor.
11. Transfer function of AC servo motor.
12. OC and SC test on single phase transformer.

ME 106	COMPUTATIONAL LAB	L	T	P	C
		0	0	3	1

(Common for Mechanical, Aeronautical & Automobile Engineering)

OBJECTIVES

- To learn and practice the fundamentals of a suitable programming language for the mathematical simulation of Mechanical Systems.
- To learn and practice computer aided drafting of simple components.

EXERCISES:

I Programming (30)

1. Finding the real roots of polynomials
2. Finding the inverse of a Matrix
3. Finding parameters like mean, median, mode, variance, skew and Kurtosis for a given data file
4. Finding the Eigen value and Eigen Vectors of Matrices
5. Numerical integration
6. Solving set of simultaneous equations
7. Plotting simple curves like circle, ellipse, parabola etc.
8. Plotting any one synthetic curve

II Computer Aided Drafting (15)

Students must be taught the fundamentals of any one drafting package. The coverage must include isometric and orthographic drawing of simple components.

ME 107	DESIGN APPRECIATION LAB	L	T	P	C
		0	0	3	1

(Common for Mechanical, Aeronautical & Automobile Engineering)

OBJECTIVES

- To understand the importance of design features in engineering components
- To appreciate the use of various mechanisms in the functioning of engineering systems.

EXERCISES:

Study of standard components

1. Dismantling and assembly of work holding devices
2. Dismantling and assembly of fixed ratio reduction gear box
3. Dismantling and assembly of automotive gearbox and clutch
4. Dismantling and assembly of reciprocating pump
5. Dismantling and assembly of centrifugal pump and submersible pump
6. Dismantling and assembly of compressor and blower
7. Dismantling and assembly of two stroke petrol engine
8. Dismantling and assembly of valves
9. Dismantling and assembly of differential and rear axle
10. Study of Mechanical components in electronic devices
11. Study of pneumatic devices
12. Dismantling and assembly of carburetor and fuel feed pump
13. Dismantling and assembly of steering and front axle
14. Dismantling and assembly of four cylinder four stroke diesel engine
15. Study of mechanisms in machine tools

EN102	COMMUNICATION SKILLS LABORATORY- I (COMMON FOR ALL BRANCHES)	L	T	P	C
		0	0	3	1

OBJECTIVES:

1. To help students interact with people effectively in various academic and professional situations.
2. To prepare students for placement interviews.
2. To enable students understand Spoken English in real-life and business situations.
4. To develop the writing ability of students by providing them required practice.
5. To familiarize students with the words used in both technical and business contexts.

UNIT I USE OF LANGUAGE IN BUSINESS CONTEXT 4

Face to face conversations - Greeting friends and strangers, Introducing, etc., Situational conversations - Asking for and giving information, Agreeing and disagreeing, etc., Telephonic conversations - Preparing to make a telephone call, receiving a telephone call, taking and leaving telephone messages, etc., Buying and selling a product, Making arrangement for meetings.

UNIT II LISTENING IN CONTEXT 10

Listening to monologues and short conversations based on a variety of sources including interviews, telephone calls, face-to-face conversations - listening to people, listening for instructions (business related), followed by two forms of multiple choice tasks and note completion tasks-- Listening to texts lasting three minutes which is generally in the form of an interview or a discussion with two or more speakers, Listening to longer texts in order to listen for clues and prompts relating to purpose.

UNIT III SPEAKING IN CONTEXT 12

Selling a product- Describing brands and markets- discussing different advertising methods and marketing techniques, Pronunciation - Stress, Word Stress (giving opinion), Sentence Stress (talking about plans, interpretation of meanings), Pitch and Intonation (talking about problems), Role play, Conducting and participating in meetings, Making a telephone call to a supplier, interviewing a company owner, Persuading/Convincing a customer to buy a product.

UNIT IV READING IN CONTEXT **7**

Reading articles from magazines or newspaper- Extracting relevant information, scanning the text for specific information, Cloze passage, Reading mini case studies (on corporate situations like launching and marketing a product, customer care, etc.).

UNIT V WRITING IN CONTEXT **12**

Writing emails, (Inter-office communication) -memos, phone messages, Writing a fax, Writing Letters - to express thanks to a host- to express interest in a product, (Business Letters - Making Enquiry about a product, Calling for Quotation, Seeking Clarification, Placing an Order and Making a Complaint,) Interpretation of data

Total: 45 Hrs

REFERENCES :

1. BEC Preliminary, Cambridge University Press, New York. 2002.
2. Bill Mascull. 'Business Vocabulary in Use' Cambridge University Press. Cambridge, 2002.
3. Bill Mascull. 'Business Vocabulary in Use' Advanced. Cambridge University Press. Cambridge, 2004.
4. Comfort, Jeremy. Et.al. 'Speaking Effectively: Developing Speaking Skills for Business English.' Cambridge University Press. Cambridge, 1984.
5. John Seely, 'Oxford Guide to Speaking and Writing'. Oxford University Press, New Delhi, 2004.
6. Leo Jones. 'New International Business English Student's book. Cambridge University Press. 2003.
7. Leo Jones. 'New International Business English' Teachers' book. Cambridge University Press. Cambridge. 2003.
8. Mohan ,Krishna & Meera Bannerji. 'Developing Communication Skills'. Macmillan India Ltd., Chennai. 2001.
9. Norman Whitby, ' Business Benchmark.' Bulat edition. Cambridge University Press, New Delhi. 2006.

10. Richards, Jack.C. 'New Interchange: English for International Communication.' Foundation Books Pvt. Ltd., New Delhi, 2006.

11. Simon Sweeney. 'Communicating in Business' Student's Book. Cambridge University Press. Cambridge, 2003.

12. Simon Sweeney. 'Communicating in Business' Teacher's Book. Cambridge University Press. Cambridge, 2004.

Assessment: Continuous Assessment

SEMESTER - III

MA 201	**MATHEMATICS – III**	**L**	**T**	**P**	**C**
	(Common to all branches)	**3**	**1**	**0**	**4**

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9

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 9

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 identity - Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 12

Classification of second order quasi 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 9

Fourier integral theorem - Fourier transform pair - Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 6

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

TOTAL: 60

REFERENCES:

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.
3. S.Rajasekaran, A.Chandrasekaran "Engineering Mathematics Volume III "Dhanam Publishers,Chennai
4. 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.

ME 202 FLUID MECHANICS AND MACHINERY **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the behavior and properties of fluid.
- To study the concept of fluid statics, fluid dynamics, fluid kinematics and its application.
- To study the governing equation for the fluid motion and apply them to the real life fluid flow problems.
- To study the behavior of viscous and incompressible flow.
- To understand the energy transfer process in fluid machines like turbines and pumps.

UNIT I BASIC CONCEPTS AND PROPERTIES **6**

Fluid - definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapor pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS **12**

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 - flow net - fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation - applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's - n - Theorem- applications - similarity laws and models.

UNIT III INCOMPRESSIBLE FLUID FLOW **12**

Viscous flow - Navier-Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy -weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel- power transmission - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

UNIT IV HYDRAULIC TURBINES **8**

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagrams - head and specific work - components of energy transfer - degree of reaction.

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies -performance curve for turbines.

UNIT V HYDRAULIC PUMPS **7**

Pumps-definition and classifications - Centrifugal pump: classifications, working principle, velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principle, indicator diagram, work saved by air vessels and performance curves - cavitation in pumps - rotary pumps: working principles of gear and vane pumps

TOTAL: 45

TEXT BOOKS:

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd, New Delhi, 1995
2. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995.
3. Vasandani, V.P., "Hydraulic Machines - Theory and Design", Khanna Publishers.1992

REFERENCES:

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hili, 1983.
2. White, F.M., "Fluid Mechanics", Tata McGraw-Hili, 5th Edition, New Delhi, 2003.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.
4. Som, S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hili, 2nd Edition, 2004.

EC 288 ELECTRONICS FOR MECHANICAL SYSTEM L T P C
3 0 0 3

OBJECTIVES:

- To require the knowledge on basic concepts of electronic components, devices and circuits.
- To gain knowledge on microprocessor and its industrial applications.

UNIT I SEMICONDUCTORS AND RECTIFIERS 9

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zener effect-Zener diode characteristics-Half wave and full wave rectifiers -Voltage regulation.

UNIT II TRANSISTORS AND AMPLIFIERS 9

Bipolar junction transistor- CB, CE, CC configuration and characteristics-Comparison-Field effect transistor-Configuration and characteristic-SCR, Diac, Triac, UJT-Characteristics and simple applications-MOSFET:PMOS.NMOS-Structure and characteristics.

UNIT III DIGITAL ELECTRONICS 10

Number system: Binary, Octal and Hexadecimal - Binary Arithmetic Operations-Boolean Algebra-Logic gates-Implementation of combinational circuits using logic gates-Half and full adders-Flip Flops: SR, JK, and D FF-Truth tables and circuits-Shift Registers-Ripple Counters.

UNIT IV 8085 MICROPROCESSOR 9

Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR 8

Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control- Memory Interfacing-memory mapping-I/O Interfacing: I/O mapped I/O and Memory mapped I/O-The intel 8255 PPI.

TOTAL: 45

TEXT BOOKS:

1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hili publishers, 1995.

2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCES:

1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hili, 1996

2. Mehta V.K, "Principles of Electronics", S. Chand and Company Ltd, 1994

3. Dougles V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hili, 1999.

4. Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and Circuits" First Edition, Tata McGraw-Hili, 1999.

AU 201 MANUFACTURING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart the knowledge on manufacturing techniques of automotive components.
- To study the different types of manufacturing and joining processes.
- To understand the recent manufacturing techniques adopted for automobiles.

UNIT I CASTING **08**

Casting types, procedure to make sand mould, types of core making molding tools, machine molding, special molding processes - CO2 molding, shell molding, investment molding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING **08**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

UNIT III MACHINING **13**

General principles of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines.

General principles and application the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

UNIT IV FORMING AND SHAPING OF PLASTICS **07**

Types of plastics - Characteristics of the forming and shaping processes - Molding of Thermoplastics - Working principles and typical applications of - Injection molding -Plunger and screw Machines - Blow molding - Rotational molding - Film blowing - Extrusion – Typical Industrial applications - Thermoforming – Processing of Thermosetting - Working principle and typical

applications - Compression molding - Transfer molding – Bonding of Thermoplastics - Fusion and solvent methods - Induction and Ultrasonic Methods

UNIT V FORMING AND POWDER METALLURGY 09

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy - Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

TOTAL: 45

TEXT BOOKS

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing processes", Prentice-Hall of India Private Limited, 2007.

REFERENCES

1. Serope Kalpajian, Steven R.Schmid, "Manufacturing Process for engineering Materials", 4/e, Pearson Education, Inc. 2007.
2. R.K.Jain and S.C. Gupta, "Production Technology", Khanna Publishers, 16th Edition, 2001.
3. "H.M.T. Production Technology - Handbook", Tata McGraw Hill , 2000.
4. Roy. A. Linberg, "Process and Materials of Manutacture”, PHI, 2000.
5. M. Adithan and A.B. Gupta, "Manufacturing Technology Age, 2006.

AU 202 APPLIED THERMODYNAMICS L T P C
3 0 0 3

OBJECTIVES:

- I understand fundamental concepts of thermodynamic processes and its applications.
- To study the different thermodynamic processes and cycles.
- To understand thermodynamic principles, relations.
- To understand the automotive refrigeration and air conditioning principles.

UNIT I FIRST LAW OF THERMODYNAMICS 12

System, thermodynamic equilibrium, state, property, process, cycle, zeroth law of thermodynamics, energy, work, heat, first law of thermodynamics, PMM I, ideal gases, application of first law of thermodynamics to closed and open systems, pressure – volume diagrams, steady flow process, application of steady flow energy equation.

UNIT II SECOND LAW OF THERMODYNAMICS 12

Limitations of first law, statements of second law of thermodynamics, PMM II, Clausius inequality, heat engine, heat pump, refrigerator, carnot cycle, carnot theorem, entropy, temperature – entropy diagram, entropy changes for a closed system.

UNIT III GAS POWER CYCLES, FLUID FLOW AND VAPOUR POWER CYCLES 12

Air standard Brayton cycle with intercooling, reheating and regeneration properties of steam, one dimensional steady flow of gases and steam through nozzles and diffusers, Rankine cycle.

UNIT IV RECIPROCATING AIR COMPRESSORS, REFRIGERATION CYCLES 12

Single acting and double acting air compressors, work required, effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, multistage compression, condition for minimum work. Fundamentals of refrigeration, C.O.P., reversed carnot cycle, simple vapor compression refrigeration system, T-S, P-H diagrams, simple vapor absorption refrigeration system, desirable properties of an ideal refrigerant.

UNIT V THERMODYNAMIC RELATIONS AND PSYCHROMETRY 12

Thermodynamic relations, Maxwell's Equations, TDS equations, Joule Kelvin effect, Clausius – Clapeyron equation. Psychrometrics , properties of atmospheric air, Psychrometric properties ,dry bulb temperature, wet bulb temperature and dew point temperature, specific humidity, relative humidity, degree of saturartion,use of psychrometric chart, simple problems.

TOTAL: 60

TEXTBOOKS

1. R.K.Rajput – "A Textbook of Engineering thermodynamics"- Laxmi Publications (P) Ltd, New Delhi-2001.
2. P K Nag – " Engineering thermodynamics" – Fourth Edition Tata McGraw Publishing Co. Ltd, New Delhi
3. Biray K. Dutta – "Heat Transfer Principles and Applications"- Prentice hall of India, New Delhi- 2003
4. R.Rudramoorthy- "Thermal Engineering" - Tata McGraw Publishing Co. Ltd, New Delhi- 2003

REFERENCES

1. R.S.Khurmi, J.K.Gupta – "A textbook of Thermal Engineering"- S.Chand & company Ltd- 2003.
2. E.Ratha Krishnan "Fundamentals of Engineering thermodynamics", Eastern Economy Edition-Prentice Hall of India Private Limited, New Delhi–110 001, 2000.
3. Yunus A. Cengel, Michael A.Boles – "Thermodynamics An Engineering approach"- Third Edition- 2002.
4. Y.V.C.Rao – Heat transfer – University press, Hyderabad – 2001.

AU 203 MATERIALS TECHNOLOGY FOR AUTOMOBILES **L T P C**
3 0 0 3

OBJECTIVES:

- To impart the knowledge on metal structure, properties, heat, treatment used for automotive components.
- To study the different types of materials and its mechanical properties used for automobiles.
- To understand various material testing procedures and standards.

UNIT I CONSITITUION OF ALLOYS AND PHASE DIAGRAMS 10

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. 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 II HEAT TREATMENT 11

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. Applications of heat treatment practice for automotive components.

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 iron. Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys.Case Study:Study of various ferrous and non ferrous automotive components and their material properties, latest developments.

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 formal deliydes –

Engineering Ceramics – Properties and applications of Al_2O_3, SiC, SiC, Si_3, Composites Materials for Tyres and Houses N4 and Silicon – Fiber and particulate reinforced composites. Case Study: Study of various non-metallic parts in automobiles and their properties.

UNIT V MECHANICAL PROPERTIES AND TESTING 6

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. Case Study: Selection of materials for typical automotive components.

TOTAL : 45

TEXT BOOK

1. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.

REFERENCES

1. William D Callsber "Material Science and Engineering", John Wiley and Sons 1997.
2. Raghavan.V.Materials Science and Engineering, Prentice Hall of India Pvt. Ltd., 1999.
3. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw-Hill Book Company, 1994.

ME 307 MATERIAL TESTING AND CHARACTERIZATION LABORATORY **L T P C 0 0 3 1**

OBJECTIVES:

- To study mechanical Characteristics and metals.
- To study the microstructure of metals and non metals.
- To study the mechanical properties of metals.

Introduction to standards

ASTM E3 - 01 (2007) e1 Standard Guide for Preparation of Metallographic Specimens

ASTM E407 - 07 Standard Practice for Micro etching Metals and Alloys

ASTM E2014 - 99(2005) Standard Guide on Metallographic Laboratory Safety
ASTM E7 - 03(2009) Standard Terminology Relating to Metallography

ASTM E112 - 10 Standard Test Methods for Determining Average Grain Size

1. Study of metallurgical microscope.
2. Sampling and Specimen preparation for microstructure examination.
3. Selections of etchants for various metals and alloys.
4. Determination of grain size of low carbon steels.
5. Microstructure examination of plain carbon steels-Low carbon, medium carbon, high carbon steels.
6. Microstructure examination of cast iron - white, grey, malleable, spheroid graphite iron.
7. Microstructure examination of alloy steels.
8. Microstructure examination of non ferrous alloys.
9. Heat treatment study - full hardening and tempering.
10. Hardenability test - Jominy End quench test.
11. Tension test on a mild steel rod.
12. Double shear test on Mild steel and Aluminium rods.
13. Torsion test on mild steel rod.
14. Impact test on metal specimen.

15. Hardness test on metals - Brinell and Rockwell Hardness Number.
16. Deflection test on beams.
17. Compression test on helical springs.
18. Fatigue test.

TOTAL: 45

EC 289 ELECTRONICS AND MICROPROCESSORS LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

- To understand operating principles and applications of electronic devices and microprocessors.
- To study the characteristics of different electronic devices.
- To perform the various arithmetic operations using microprocessor.

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. Study of Logic Gates (Basic Gates).
7. Half Adder and Full Adder.
8. Shift Registers.
9. 3 bit binary ripple counters.

MICROPROCESSOR **15**

1. 8 bit Addition, Subtraction.
2. 16 bit addition and subtraction.
3. Multiplication and Division.
4. Maximum and Minimum of block of data.
5. Sorting and block transfer.
6. Stepper Motor Interfacing.

TOTAL: 45

AU 204 MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	1

AIM:

To have hands on training in operating lathe, shaper, drilling, milling and grinding machines and its applications to manufacturing automotive components.

OBJECTIVES:

- To perform various lathe operations like facing, turning.
- To perform the various machining operations using shaper and slotter.
- To perform drilling and grinding operations.

LIST OF EXPERIMENTS

1. LATHE

1.1. Facing, plain turning and step turning.

1.2. Taper turning using compound rest.

1.3. Taper turning using taper turning attachment.

1.4. Single start V thread, cutting and knurling.

1.5. Boring and internal thread cutting.

2. SHAPER AND SLOTTER

2.1. Machining a V- block (in a Shaper)

2.2. Machining hexagonal shape (in a shaper)

2.3. Machining internal key-way (in a slotter)

3. DRILLING

3.1. Drilling 4 or 6 holes at a given pitch circle on a plate

3.2. Drilling, reaming and tapping

4. MILLING

4.1. Plain milling

4.2. Gear milling

5. GRINDING

5.1 Cylindrical Grinding

TOTAL : 45

EN201	COMMUNICATION SKILLS LABORATORY-II	L	T	P	C
	(COMMON FOR ALL BRANCHES)	0	0	3	1

OBJECTIVES:

- To acquire Business English qualification at Vantage level.
- To develop interpersonal and social skills.
- To develop their writing skills in order to write reports.
- To improve their speaking skills so as to converse in their professional and business situations.

UNIT I DISCUSSION SKILLS **9**

Negotiations - Types of Negotiations - Selling and Buying Products, Negotiating face to face and on the Phone - Bargaining and Making Concessions-. Group Discussions.

UNIT II PRESENTATION SKILLS **9**

Tips for effective Presentation, Different types of Presentation - Sales Presentation, Project Presentation, etc., Presentation practice.

UNIT III BUSINESS COMMUNICATION SKILLS **9**

Writing Minutes - Note making - Letter Writing - Applying for Jobs, CV Writing, To invite a candidate for an interview, Job promotion letters.

UNIT IV INTERVIEW SKILLS **9**

Preparing for Interviews - Etiquette, Body Language, Dress Code etc., Mock Interviews

UNIT V MANAGERIAL AND SOCIAL SKILLS **9**

Organizing, Conducting and Participating in Meetings - Interacting with people - Time Management - Writing Business Reports - Language and Style, Reports on Conferences, Meetings.

TOTAL: 45

REFERENCES

1. BEC Vantage, Cambridge University Press. Edition 2005.
2. Bill Mascull. 'Business Vocabulary in Use. Cambridge University Press. Cambridge, 2002.
3. Bill Mascull. 'Business Vocabulary in Use' Advanced. Cambridge University Press. Cambridge, 2004.
4. Comfort, Jeremy. Et.al. 'Speaking Effectively: Developing Speaking Skills for Business English.' Cambridge University Press. Cambridge, 1984.
5. Gerson, Sharon, Steve M.Gerson. 'Technical Writing: Process and Product' Pearson Education, New Delhi. 2004.
6. Leo Jones. 'New International Business English' Students book. Cambridge University Press. 2003.
7. Leo Jones. ' New International Business English ' Teachers' book. Cambridge University Press. Cambridge. 2003.
8. Richards, Jack.C. 'New Interchange: English for International Communication.' Foundation Books Pvt. Ltd., New Delhi, 2006
9. Riordan, Pauley. 'Report Writing Today' AITBS Publisher, New Delhi. 2000.
10. Rutherford, Andrea. J. 'Basic Communication Skills For Technology' Pearson Education Asia. 2002.
11. Simon Sweeney. 'Communicating in Business' Students' Book. Cambridge University Press. Cambridge, 2003.
12. Simon Sweeney. 'Communicating in Business Teacher's Book. Cambridge University Press. Cambridge, 2004.

SEMESTER – IV

		L	T	P	C
MA 207	**STATISTICS AND NUMERICAL METHODS**	**3**	**1**	**0**	**4**

AIM:

To provide the required skill to apply the statistical tools in engineering problems and give procedures for solving numerically the different kinds of problems occurring in engineering and technology.

OBJECTIVES:

- To acquire knowledge of the concepts of statistical inference.
- To get exposure to the basic concepts of numerical methods and their applications.

UNIT I TESTING OF HYPOTHESIS 9

Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9

Completely randomized design – Randomized block design – Latin square design – 22 - factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method .

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9**

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge- Kutta method for solving first and second order equations - Milne's predictor-corrector methods for solving first order equations - Finite difference methods for solving second order equation.

TOTAL 60

TEXT BOOKS

1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 3, 4 and 5).

2. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.

REFERENCES:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th edition, 2007.

2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.

3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.

4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.

ME 209 **SOLID MECHANICS** **L T P C**
3 1 0 4

OBJECTIVE:

1. To acquire knowledge on analysis of various structural elements for different loading conditions and appreciate its application in automotive systems and components.
2. To gain knowledge of simple stresses, strains and deformation in components due to external loads.
3. To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
4. Effect of component dimensions and shape on stresses and deformations are to be understood.
5. The study would provide knowledge for use in the design courses.

UNIT I STRESS STRAIN AND DEFORMATION OF SOLIDS 9

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 loads.

UNIT II BEAMS - LOADS AND STRESSES 9

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 - Shear flow.

UNIT III TORSION 9

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's Factor - Deflection of helical coil springs under axial loads - Design of helical coil springs - stresses in helical coil springs under torsion loads.

UNIT IV BEAM DEFLECTION 9

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 9

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 – Hoop Stress -Theories of Failure.

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-Hili Book Co, Third Edition, 2002.

REFERENCES:

1. Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hili Book Co, New York, 1995
2. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hili 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.
6. Timoshenko S.P, Elements of Strength of Materials, Tata McGraw-Hili, New Delhi 1997.

ME 310 METROLOGY AND MECHANICAL MEASUREMENTS L T P C

3 0 0

OBJECTIVE:

1. To acquire fundamental knowledge on various measurement devices and instruments.
2. To learn the different types of measurement like linear, angular and temperature.
3. To study the laser measurement techniques.
4. To study the vibration and acoustic measurement technique.

UNIT I MEASUREMENT CONCEPT 10

Definition of metrology, General Concepts of 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, traceability. Statistical concepts: Mean, Range, Variance and Standard deviation

UNIT II LINEAR, ANGULAR AND FORM MEASUREMENT 11

Linear measuring instruments: Slip gauges, Tool Maker's microscope, limit gauges. Comparators: Mechanical, pneumatic and electrical types, applications. Angular measurements: -Sine bar, bevel protractor-Taper angle measurements- Form measurement- Measurement of screw threads- floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method- straightness, flatness and roundness measurements- surface finish-surface roughness tester.

UNIT III LASER AND ADVANCES IN METROLOGY 8

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications.- computer aided inspection. Machine Vision systems - principle and functions.

UNIT IV FORCE, TORQUE AND TEMPERATURE MEASUREMENT 8

Response of Measuring System: Amplitude, Frequency and Phase - Force, torque measurement- mechanical, pneumatic, hydraulic and electrical type-Flow measurement-Temperature measurement- bimetallic strip, pressure thermometers, thermocouples, electrical resistance thermister.

UNIT V VIBRATION AND ACOUSTIC MEASUREMENT 8

Vibration measurement - Vibrometers and accelerometers, test methods and calibration- Acoustic Measurement- AE Parameters, principles of acoustic emission techniques,- Advantages, limitations and applications.

TOTAL: 45

TEXT BOOKS :

1. Jain R.K., "Engineering Metrology", Khanna Publishers, 1994.
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997.

REFERENCES:

1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 1984.
2. Beckwith T.G, and R.D.Marangoni, "Mechanical Measurements", Addison Wesley, 1999.
3. Donald D Eckman, "Industrial Instrumentation", Wiley Eastern, 1985.
4. ASTME, "Hand book of industrial metrology" Prentice Hall of India,1988.
5. ASNT, "Nondestructive testing handbook Emission" Volme.5- Acoustic emission testing,1994.

AU 205 PETROL ENGINES L T P C

3 0 0 3

OBJECTIVE

- To enable the students to learn the different components and working of petrol engines and its latest developments.
- To learn the fundamental principles, construction working and auxiliary systems of automotive petrol engines.
- To learn the design principles of automotive petrol engines.

UNIT I ENGINE CONSTRUCTION AND OPERATION 9

Constructional details of four stroke petrol engine, working principle, air standard Otto cycle, actual indicator diagram, two stroke engine construction and operation, comparison of four stroke and two stroke engine operation, firing order and its significance. Port Timing, Valve Timing of petrol engines. Variable Cam timing, Twin independent Cam shafts

UNIT II SI ENGINE FUEL SYSTEM 9

Carburetor working principle, requirements of an automotive carburetor, starting, idling, acceleration and normal circuits of carburetors. Compensation, maximum power devices, constant choke and constant vacuum carburetors, fuel feed systems; mechanical and electrical fuel feed pumps. Petrol injection, MPFI. Inlet Air compression (Super charging), Gasoline Turbo Direct Injection

UNIT III IGNITION SYSTEM 9

Types and working of battery coil and magneto ignition systems, relative merits and demerits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, electronic ignition systems. Ignition distributor

UNIT IV COOLING AND LUBRICATION SYSTEM 9

Need for cooling system, Types of cooling system: air cooling system, liquid cooling system, forced circulation system, pressure cooling system. Lubrication system; mist, wet sump lubrication system, properties of lubricants.

UNIT V COMBUSTION AND COMBUSTION CHAMBERS 9

Combustion in SI engine; stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, detonation, effect of engine variables on

knock, knock rating. Combustion chambers; different types, factors controlling combustion chamber design.

TOTAL : 45

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engines”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L.Mathur and R.P.Sharma, “A course in Internal combustion engines”, Dhanpat Rai & Sons Publications, New Delhi, 2001.
3. K.K.Ramalingam, “Internal Combustion Engines”, Scitech Publications, Chennai, 2000.

REFERENCES:

1. Heldt P.M., “High Speed Combustion Engines”, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., “Internal Combustion Engines Analysis and Practice”, International Text Books Co., Scrantron, Pennsylvania - 1988.
3. William H.Crouse, “Automotive Engines”, McGraw-Hill Publishers, 1985.
4. Ellinger H.E., “Automotive Engines”, Prentice Hall Publishers, 1992.
5. John B.Heywood, “Internal Combustion Engine Fundamental”, McGraw-Hill, 1988.
6. Pulkrabek “Engineering Fundamentals of the Internal Combustion Engines”, Practice Hall of India, 2003.

AU 206 HEAT TRANSFER AND HEAT EXCHANGER L T P C

3 0 0 3

(Use of standard heat and mass transfer data book is permitted in the University examination)

OBJECTIVES:

- To understand fundamental concepts of heat transfer and mass transfer.
- To learn the fundamental modes of heat transfer and mass transfer.
- To learn the design principles of heat exchangers.

UNIT I CONDUCTION 11

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 - Conduction with Internal Heat Generation - Extended Surfaces - Unsteady Heat Conduction - Lumped Analysis - Use of Heislers Chart.

UNIT II CONVECTION 10

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 - Flow over Bank of tubes - Free Convection - Dimensional Analysis - Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers - LMTD Method of heat Exchanger Analysis - Effectiveness - NTU method of Heat Exchanger Analysis - Overall Heat Transfer Coefficient - Fouling Factors.

UNIT IV RADIATION 8

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 REFRIGERATION AND AIR CONDITIONING 8

Compressors – reciprocating and rotary (elementary treatment), Types of condensers, evaporators, cooling towers – Functional aspects. Refrigerants – properties – selection of refrigerants, Alternate Refrigerants, Cycling controls. Psychometric processes use of psychometric charts – Grand and Room Sensible Heat Factors – bypass factor – air washers, requirements of comfort air conditioning, summer and Winter Air conditioning. Cooling load calculation working principles of – Centralized Air conditioning systems, Split, Ductable split, Packaged Air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

TOTAL: 60

TEXT BOOKS:

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.
2. Yadav R "Heat and Mass Transfer" Central Publishing House, 1995.
3. Ozisik M.N, "Heat Transfer", McGraw-Hili Book Co., 1994.

REFERENCES:

1. Nag P.K, " Heat Transfer", Tata McGraw-Hili, New Delhi, 2002
2. Holman J.P "Heat and Mass Transfer" Tata McGraw-Hili, 2000.
3. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998
4. Frank P. Incorporeal and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.

AE 201 MECHANICS OF MACHINES L T P C

3 0 0 3

OBJECTIVES:

- To understand the basic concepts of mechanisms and machinery
- To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working.

UNIT I MECHANISMS 12

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

UNIT II FRICTION 12

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

UNIT III GEARING AND CAMS 12

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque- Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

UNIT IV BALANCING 12

Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.

UNIT V VIBRATION 12

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

TOTAL : 60

TEXT BOOKS :

1. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co., New Delhi, 2004.

2. Ballaney.P.L, “Theory of Machines”, Khanna Publishers, New Delhi, 2002.

REFERENCES :

1. Rao,J.S and Dukkipati, R.V, “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Ltd., 1992.

2. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, Satya Prakasam, Tech. India Publications, 1989.

3. Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 1989.

4. Shigley, J.E. and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw-Hill, 1980.

5. Burton Paul, “Kinematics and Dynamic of Planer Machinery”, Prentice Hall, 1979.

ME 314 METROLOGY AND MEASUREMENTS LAB **L T P C**

0 0 3 1

OBJECTIVES:

- To gain hands on practice of using various measurement devices and techniques on typical automotive components.
- To learn the measurement techniques adopted for various instruments.
- To measure the vibration and acoustic emission.

LIST OF EXPERIMENTS:

1. Complete measurement of the given component using standard equipments.
2. Measurements of Gear Tooth Dimensions.
3. Measurement of Angle using Sine bar / Sine Center / Tool makers microscope / Slip-gauge.
4. Measurement of straightness and flatness.
5. Measurement of thread parameters.
6. Measurement of surface roughness.
7. Modeling a free form surface using Coordinate Measuring Machine (CMM).
8. Setting up of comparators for inspection (Mechanical I Pneumatic I Electrical).
9. Measurement of Temperature.
10. Measurement of Displacement.
11. Measurement of Force and Torque.
12. Measurement of Vibration.
13. Measurement of Acoustic Emission (AE).
14. Study of Vision system.

TOTAL:45

ME 207 MACHINE DRAWING PRACTICE L T P C

0 0 3 1

OBJECTIVES:

- To develop parts and assembly drawing for manufacturing.
- To understand the symbols, limits, fits, tolerances for machine components.
- To carry out assembly drawing and production drawing.
- To study geometrical dimensioning and tolerancing.

1. DRAWING STANDARDS

Code of practice for Engineering Drawing, BIS specifications - Welding symbols, riveted joints, keys, fasteners - Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.

Limits, Fits - Tolerancing of individual dimensions- Specification of Fits- Screw threads and threaded fasteners.

2. ASSEMBLY DRAWING (USING APPLICATION DRAFTING PACKAGES)

Parts drawing and preparation of assembled views given part details for components using a suitable Drafting package.

Joints - Cotter joints, knuckle joints, Hook's joints.

Shaft Couplings: rigid, flexible.

Bearings - Journal - Footstep thrust or Collar bearing, Plummer block. Engine parts - Stuffing box, Connecting rod.

Valves - safety valve, relief valve, non-return valve.

Machine tool components - Drill jig, Tool post, machine vice, screw jack.

3. Generation of Part and Assembly Drawings given an actual Mechanical Product

4. Generation of Production Drawing, Geometrical Dimensioning & Tolerance

TOTAL: 45

REFERENCES:

1. Bhatt .N.D. and PANCHAL.V.M. "Machine Drawing", Charotar Publishing House, 388001, 38th Edition, 2003.
2. K.R. Gopalakrishnan., "Machine Drawing", 18th Edition, 2004.
3. P.S.G. Design Data Book
4. Ellen Finkelstein, "AutoCAD 2004 Bible", Wiley Publishing Inc, 2003.
5. Sham Tikoo, "AutoCAD 2002 with Applications", Tata McGraw-Hili Publishing Company, NewDelhi, 2002.

AU 207	FLUID MECHANICS AND THERMAL LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand the performance and operating characteristics of fluid machinery, IC engines, Steam generator and turbines.
- To study and conduct experiments on the flow measurement machines.
- To study the characteristics of different fluid machines.
- To conduct the performance test on fluid different fluid machines.
- To do the valve timing and port timing in IC engines.
- To conduct performance test, heat balance test and Morse test on IC engines.
- To study the measurement of viscosity, flash and fire point.

FLUID MECHANICS LAB

LIST OF EXPERIMENTS

1. Comparison of coefficient of discharge of given Orifice meter and Venturimeter.
2. Calibration of Rotameter
3. Determination of friction factor for the given set of pipes.
4. Performance study of Centrifugal pump / Submersible pump
5. Determination of maximum efficiency for the given Reciprocating pump.
6. Characteristic curves of Gear pump / Vane pump
7. Determination of the maximum power at constant speed / constant load for an Impulse turbine.
8. Performance characteristics of Reaction turbine.
9. Impact of jet on flat and curved vanes
10. Verification of Bernoullis equation
11. Performance test on a jet pump.

THERMAL LAB

LIST OF EXPERIMENTS:

I.C ENGINE LAB AND FUELS LAB

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 Multi cylinder 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.

8. STEAM LAB

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

TOTAL: 45

GE 202 CONFIDENCE BUILDING AND BEHAVIORAL SKILLS (Common for all branches) **L T P C 0 0 2 1**

Course objective

The objective of the course is to impart confidence to students and competence in soft skills.

Learning Outcomes:

By the end of the soft skills training program, the students should be able to:

- Develop effective soft skills.
- Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.
- Develop all-round personalities with a mature outlook so as to function effectively in different circumstances.

Topics Outline:

This course is practical oriented one and exercises will be given to the students group users/individually syllabi. The exercises will be designed by the faculty member.

- Soft skills definition, examples
- Attitude and Behavior: role play and exploration, case studies
- Team work and respect: case study
- Helping others-communication and group discussion
- Ability to ask for help-communication and team work
- Manners and etiquette
- Verbal communication: case study, communication and discussion
- Organization and Planning
- Time keeping
- Conduct in workplace
- Conscientiousness
- Work output
- Professionalism
- Motivation

- Attendance
- Ownership of tasks
- Adaptability/flexibility

Assessment:

The assessment will be continuous and portfolio based. The must produce the record of the work done through the course of the semester in the individual classes. The portfolio may consist of a) the individual task outline and activities. B) worked out activities c) Pre-designed sheets which may be provided by the Faculty member. The portfolio will be used by the Faculty member for assessment. The course coordinator in consultation with the course committee shall decide at the beginning of the semester, the number of exercises, method of assessment of each and the weightage for the end semester assessment.

SEMESTER V

AU 301 DESIGN OF AUTOMOTIVE COMPONENTS I

L	T	P	C
3	1	0	4

OBJECTIVES:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data.
- To learn to use catalogues and standard machine components.

UNIT I INTRODUCTION **12**

Classification of design - Engineering materials and their physical properties as applied to design - Selection of materials - Factors of safety in design - Endurance limit of materials - Determination of endurance limit for ductile materials - Notch sensitivity Principle of design optimization - Future trends - CAD Euler's formula - - Rankine's formula - Tetmajer's formula - Johnson formula - Design of push rods and eccentricity loaded columns - Reduction of stress concentration.

UNIT II DESIGN OF SHAFTS AND SPRINGS **9**

Introduction - Material and design stresses - Design of axles - Design of shafts on the basis of strength - Design of shaft on the basis of rigidity - Design of hollow shafts - Design of close coiled helical spring subjected to axial loading - Torsion of helical springs.

UNIT III GEAR DESIGN **8**

Design considerations - strength of gear teeth - Lewis equation - Terminology of gears Dynamic tooth load - Design of spur gears - helical gears - herringbone gears - bevel gears and worm gears.

UNIT IV FLYWHEELS **7**

Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheels stresses of rim of flywheels. Design of hubs and arms of flywheel - Turning moment diagram.

UNIT V DESIGN OF BEARINGS **9**

Design of journal bearings - Ball and Roller bearings - Types of Roller bearings - Bearing life - Static load capacity - Dynamic load capacity - Bearing material - Boundary lubrication - Oil flow and temperature rise.

TOTAL: 45

TEXT BOOKS:

1. Jain,R.K., "Machine Design", Khanna Publishers, 1992.
2. Sundararaja Murthy, T.V., "Machine Design", Khanna Publishers, New Delhi, 1991.
3. Bhandari,v.B., "Design of Machine Elements", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.

REFERENCES:

1. Hall Allen,S. & other, “Machine Design”, Schaum publisher Co., 1982.
2. Sigley, “Machine Design”, McGraw Hill,1981.
3. “Design Data Book”, PSG College of Technology, Coimbatore,1992

AU 302 DIESEL ENGINES L T P C
3 0 0 3

OBJECTIVES:

- To learn basic concepts on Automotive Diesel Engines and its various sub components along with its functions.
- To learn the different systems of Automotive Diesel Engines.

UNIT I DIESEL ENGINE BASIC THEORY 9

Diesel engine construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel-air and actual cycle analysis. Diesel fuel. Ignition quality. Cetane number. Laboratory tests for diesel fuel. Standards and specifications.

UNIT II FUEL INJECTION SYSTEM 9

Requirements – solid injection. Function of components –common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Mechanical and pneumatic governors. Fuel injector, Types of injection nozzle, Nozzle tests. Spray characteristics. Injection timing. Pump calibration. Pilot injection.

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 10

Importance of air motion – Swirl, squish and turbulence, Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting delay period. Knock in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – objectives – Different types of combustion chamber. Combustion chamber. Combustion chambers for Homogeneous charge compression ignition systems – Dual and alternate fueled engine systems.

UNIT IV SUPERCHARGING AND TURBOCHARGING 8

Necessity and limitation – Charge cooling. Types of supercharging and turbocharging – Relative merits. Matching of turbocharger. Inter cooler, Inseries Twin turbo

UNIT V DIESEL ENGINE TESTING AND PERFORMANCE 9

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Methods to improve engine performance – Heat balance –

Performance maps. Hot testing of engines, Dynamometer type, Chassis dyno for emission test

TOTAL : 45

TEXT BOOKS:

1. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.

2. Ganesan,V., Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.

REFERENCES:

1. Heldt,P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.

2. Obert,E.F., Internal Combustion Engine analysis and Practice, International Text Book Co., Scranton, Pennsylvania, 1988.

3. Maleev,V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974. Dicksee,C.B., Diesel Engines, Blackie & Son Ltd., London, 1964.

AU 303	AUTOMOTIVE CHASSIS, SUSPENSION, STEERING AND WHEELS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- Study of the Constructional details and Theory of important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles.
- Problem–Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

UNIT I INTRODUCTION, FRAME, STEERING SYSTEM 9

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

UNIT II PROPELLER SHAFT AND FINAL DRIVE 9

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi–axled vehicles, Differential principle and types, Differential housings, Non–Slip differential, Differential locks, Final drive of Crawler Tractors.

UNIT III AXLES AND TYRES 9

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

UNIT IV SUSPENSION SYSTEM 9

Need for Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details, Design of Leaf and Coil Springs.

UNIT V BRAKING SYSTEM 9

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Loading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders, Types and Construction, Anti–Lock Braking System, Constructional Details. Traction control , Hill assist, Engine brakes (alias Jake brake)

TOTAL = 60

TEXT BOOKS :

1. Kripal Singh, Automobile Engineering, Standard Publisher, New Delhi, 2006
2. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited, 2007
3. N.K. Giri, Automotive Mechanics, Kanna Publishers, 2007

REFERENCES :

1. Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
2. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
3. Heinz Hazler, Modern Vehicle Technology, Butterworth, London, 2005.

AU 304 AUTOMOTIVE TRANSMISSION SYSTEMS **L T P C**
3 1 0 4

OBJECTIVES:

- To understand construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices and automatic transmission system will be taught to the students.

UNIT I CLUTCH AND GEAR BOX **9**

Problems on performance of automobile - such as resistance to motion, tractive effort, engine speed, engine power and acceleration. Requirement of transmission system. Different types of clutches, principle, Construction and torque capacity. Determination of gear ratios for vehicles. Different types of gearboxes such as Sliding mesh gearbox, Constant mesh gearbox and Synchromesh gearbox.

UNIT II HYDRODYNAMIC DRIVE **9**

Fluid coupling - Principle of operation, Constructional details, Torque capacity, Performance characteristics and Reduction of drag torque. Hydrodynamic Torque converter - Principle of operation, Constructional details and Performance characteristics. Multistage torque converters. Polyphase torque converters. Converter coupling.

UNIT III PLANETARY GEAR BOXES **9**

Construction and operation of Ford – T-model gearbox, Wilson Gear box and Cotal electromagnetic transmission.

UNIT IV AUTOMATIC TRANSMISSION APPLICATIONS **9**

Need for automatic transmission, Principle of operation. Hydraulic control system for automatic transmission. Chevrolet “Turboglide” Transmission, Continuously Variable Transmission (CVT) – Types – Operations.

UNIT V HYDROSTATIC AND ELECTRIC DRIVE **9**

Hydrostatic drive - Various types of hydrostatic systems, Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, Construction and Working of typical Janny hydrostatic drive. Electric drive - Principle of operation of Early and Modified Ward Leonard Control system, Advantages & limitations.

TOTAL: 60

TEXT BOOKS

1. Heldt P.M – “Torque Converters”- Chilton Book Co.-1992
2. Judge, A.W., Modern Transmission systems, Chapman and Hall Ltd., 1990.
3. Newton and Steeds – “Motor Vehicle”- Illiffee Publisher- 2000.

REFERENCES

1. Design Practices, passenger Car Automotive Transmissions- SAE Hand book-1994.
2. Crouse, W.H., Anglin, D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1992.
3. Heldt, P.M., Torque converters, Chilton Book Co., 1992.

AU 305 AUTOMOTIVE ELECTRICAL & ELECTRONICS **L T P C**

3 1 0 4

OBJECTIVES:

- To understand the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, charging System, Ignition System, Lighting System and Dash – Board Instruments.

UNIT I BATTERIES **8**

Principle and construction of lead-acid battery. Characteristics of battery, rating, capacity and efficiency of batteries. Various tests on battery condition, charging methods. Details of modern storage batteries.

UNIT II STARTING SYSTEM **9**

Condition of starting Behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units. Care & maintenance of starter motor, Starter switches.

UNIT III CHARGING SYSTEM **9**

Function, Components of DC and AC Charging System for Automobile, construction, operating principle, characteristics, charging circuit controls – cut out, relays, voltage and current regulators, troubleshooting

UNIT IV IGNITION SYSTEM **10**

Types, construction & working of battery coil and magneto ignition systems. Relative merits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, Electronic Ignition system. Digital ignition system.

UNIT V LIGHTING SYSTEM & ACCESSORIES **9**

Insulated & earth return systems. Positive & negative earth systems. Details of head light & side light. Head light dazzling & preventive methods. Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, Horn, Wiper system, Trafficator, wiring system. (Accessories) - Parking assit,Button starter, Satellite navigation, Distant to Empty

TOTAL : 45

TEXT BOOK:

Judge,A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.

REFERENCES:

1. Young,A.P. & Griffiths,L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.
2. Vinal,G.W., Storage Batteries, John Wiley & Sons Inc., New York, 1985. Crouse,W.H., Automobile Electrical Equipment, McGraw Hill Book Co. Inc., New York, 1980.
3. Spreadbury,F.G., Electrical Ignition Equipment, Constable & Co. Ltd., London, 1962.
4. Kholi,P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd., New Delhi, 1975.
5. Automotive Hand Book, fifth edition, Robert Bosch, Bently Publishers, 2003.

MS 382	ENGINEERING ECONOMICS AND PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.
- To understand the value engineering and problems associated with it.
- To learn the cash flow diagram and cash flow problems.
- To study the replacement and maintenance analysis of asset.
- To learn the depreciation technique and different methods of depreciation.

UNIT I ECONOMIC CONCEPTS, DEMAND & SUPPLY 8

Microeconomics: Definition and Scope – Importance of Economics in engineering. Law of Demand and Demand Schedule – Factors influencing demand –Price elasticity of demand – Demand forecasting –Factors influencing supply.

UNIT II PRODUCTION & COSTS 8

Meaning of production function – Economies of Scale – Large scale and small scale production – production in short run and long run. Types of costs: Fixed, Variable and semi- variable costs – opportunity cost – Direct & Indirect costs –Overheads – Short run and Long run costs – Marginal cost

UNIT III MARKET, PRICING & BREAK-EVEN ANALYSIS 8

Types of market structures: Meaning and Characteristics of Monopoly, Oligopoly, Monopsony, Perfect Competition.

Pricing: Objectives of pricing – Pricing Policies – Pricing Methods

Break –even analysis: Meaning – Assumptions – Managerial uses – Limitations.

UNIT IV PROJECT MANAGEMENT 8

Overview of project management, project-selection methods, project portfolio process, process formulation, Project cost estimation.

UNIT V SCHEDULING AND RESOURCE ALLOCATION 8

PERT and CPM networks, Project uncertainty and risk management, Project Simulation and Gantt Chart. Resource leveling and smoothing.

TOTAL: 32

REFERENCES:

1. Dewett K.K, “Modern Economic Theory”, S.Chand & Company, 2003.
2. Sundram, “Indian Economy”, Sultan Chand & Company, 2004.
3. Samuel. J. Mantel et al Project Management, First Indian Edition. Wiley India 2006.
4. John M. Nicoholas, Project Management for Business and Technology – Principles and Practice, Second Edition, Pearson Education,2006.

AU 306	ENGINE COMPONENTS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVE:

- To understands the various systems and components of IC engines.
- The course helps the students to dismantle, identify the components, and assemble the different engines.
- To familiarize and train the students on the constructional arrangements of different engine system. Study of the following engines and its components by dismantling, comparing with recent engine components and assembling various parts.

LIST OF EXPERIMENTS

- Study of various types of engines, Inline, V-type, opposing, SI, CI engines.
- Study of engines-cars, SUUS, LCVS, Trucks, leavy duty engines.
- Study of Enginer management system, Electronic control modules
- MPFI system, Direct fuel injection
- Gas Enginer
- Study of Turbo chargers, Super chargers.
- Study of engine parts, piston, connecting rod, Crank shaft, cam shaft, valves, valve timing, liners, sleeve caring
- Study of design innovations in engine componants and engine technology
- Study of fits and folerance in engine assumbly function
- Catalytic converters.

TOTAL:45

AU 307	FOUR WHEELER LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- The course enables the students to study the different types of chassis and its components.
- To familiarize and understand the constructional arrangements of different chassis system.
- To Study the different components in chassis and its measurement.

LIST OF EXPERIMENTS

1. Study of front wheel geometry
2. Study of front Axle, Rear Axle
3. Study of mechanical friction clutches, fluid coupling
4. Study of fear boxes - Sliding Mesh, Constant Mesh, Synchromesh and Automatic transmissions.
5. Study of Mechanical & Power Streering systems
6. Study of various mechanical steering gear boxes
7. Study of Mechanical, Hydraolic & Pneumatic Brake Systems, Drum brake & Dise Brakes
8. Study of Construction of Main Frames of Trucks.
9. Study of Electrical System - Battery, Wiring, Lighting, Controls, Charging Battery, Entertainment, Startermotor, Viper motor, Centralised locking etc.
10. Study of Safety modules in automobiles
11. Study of Supervision Systems & Types

TOTAL: 45

AU 308	ENGINE TESTING AND EMISSION MEASUREMENT LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

1. To carryout performance and emission test on IC engines and understand the engine performance.
2. To conduct Morse test and heat balance test on IC engines.
3. To learn the new and understand frictional courses in engines emission measurement techniques adopted for automobiles.
4. To understand vehicle performance.

LIST OF EXPERIMENTS

1. Study and use of IC engine testing Dynamometers.
2. Study of 2 and 4 wheeler chassis Dynamometers.
3. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
4. Performance study of petrol engine at full throttle and part throttle conditions.
5. Performance study of diesel engine both at full load and part load conditions. Morse test on petrol and diesel engines.
6. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
7. Heat balance test on a Automotive diesel engine.
8. Engine tuning for performance improvement.
9. Testing of 2 and 4 wheelers using chassis dynamometers.
10. Study of NDIR Gas Analyser and FID.
11. Study of Chemiluminescent NOx analyzer.
12. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer.
13. Diesel smoke measurement.
14. Control of Emissions: Euro & Bharat Norms,
15. Diesel particulate Filter
16. Exhaust gas regulation
17. Selective catalytic reduction

TOTAL :45

GE 301	CAREER BUILDING AND PEOPLE SKILLS (Common for all branches)	L	T	P	C
		0	0	2	1

Course Objective:

The objective of the course is to prepare the students for building their conpetencies and career building skills.

Learning Outcomes :

The course will help the students to

- Develop effective presentation skills
- Develop all-round personalities with a mature outlook to function effectively in different circumstances.
- Develop broad career plans, evaluate the employment market, identify the potential organizations to get good placement, match the job requirements and skill sets.
- Take part effectively in various selection procedures followed by the recruiters.

Course outline:

This course is practical oriented one and exercises will be given to the studetns group users/individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member.

- Creation of awareness of the top companies / different verticals / courses for improving skill set matrix.
- Industry expectations to enable the students to prepare for their career.
- Group discussions : Do's and Don'ts - handling of Group discussions – What evaluators look for. Overcoming of inferiority / superiority complex.

  Interview - awareness of facing questions - Do’s and Don’ts of personal interview.

  Selection of appropriate field vis-a-vis personality / interest.
- Preparation of Curriculum Viae - Objectives, profiles vis-a-vis companies requirement.
- Enabling students to prepare for different procedures / levels to enter into any company - books / websites to help for further preparation.

- Technical interview - how to prepare and face it.
- Entrepreneurship development - preparation for tests prior to the interview - Qualities and prerequisities for launching a firm.
- Interpersonal relationships - with colleagues - clients - understanding one's own behavior perception by others.
- How to work with persons whose background, culture, language / work style different from one's own.

Assessment:

As the course is practical one, it will be assessed using a portfolio based assessment. The students must in consultation with the Faculty member, plan a portfolio of evidence for the above mentioned activities. The students must develop a resume or resumes that promote own ability to meet specific job requirements and plan their portfolio in a format appropriate to industry they wish to target. The case studies will contain direct observation of the candidate developing career plans, resumes and skills portfolio, reflect written or oral questioning to assess knowledge and problem - solving activities to assess a ability to align career aspirations with realistic with realistic career goals. The course coordinator in consultation with the course committee will decide the number of exercises and mark to be awarded for each beside the weightage for the end semester assessment.

SEMESTER VI

AU 309 FINITE ELEMENT METHODS FOR AUTOMOTIVE APPLICATIONS **L T P C 3 0 1 4**

OBJECTIVES:

- To learn the basics of FEA and its application in automobiles.
- To learn the types of element and element formulation used in FEM.
- To understand the various types of analysis like structural, thermal using FEM approach.

UNIT I INTRODUCTION **9**

Basic Concept, comparison with FDM advantages and disadvantages, history of development, application. Direct stiffness method (DSM)- Fundamental steps in DSM, Plane Truss, Idealisation, joint forces and displacements, Master stiffness Equation- formulation of element stiffness equations Assembly and solution, co-ordinate transformation -Assembly Rules - BC implementation - Calculation of Reaction, Internal forces and stresses.

UNIT II ONE DIMENSIONAL ANALYSIS **9**

Finite Element Analysis of 1D Problems - One dimensional second order equations, discretisation, weak formulation, element equations, assembly, boundary conditions, solution of equations - post processing, fourth order equations and their solutions - convergence criteria, examples from solid mechanics, heat transfer

UNIT III TWO DIMENSIONAL ANALYSIS **9**

Element Shape Functions:- Classification of C0, C1 continuous problems - Parameter functions, its properties- completeness and compatibility condition, One-dimensional elements, Global coordinates, Two-dimensional elements, three noded triangular elements and four noded quadrilateral elements. Natural co-ordinate systems -Lagrangian Interpolation Polynomials - Serendipity Formulation- Difference between Superparametric, Subparametric and Isoparametric Elements, Isoparamatric Elements Formulation, length coordinates- 1D bar elements, C0 continuous shape function, beam elements, C1 continuous shape function - 2D Triangular elements, Rectangular elements. Area coordinates- Numerical integration - simple Problems using Gauss quadrature Technique

UNIT IV FEA IN THERMAL ANALYSIS 9

Finite Element Analysis of 2D Steady State Thermal Problems - Green-Gauss Theorem-Element equation formulation - Variational calculus approach-Galerkin approach - General Two-Dimensional Heat Conduction – Axisymmetric Heat conduction -Triangular, Quadrilateral elements - Simple problems using three noded triangular element only.

UNIT V FEA IN STRUCTURAL ANALYSIS 9

Finite Element Analysis of Plane Elasticity 2D Problems - Introduction to Theory of Elasticity - Plane Stress -Plain Strain and Axisymmeteric Formulation - Principle of virtual work -Element matrices using energy approach. -Triangular, Quadrilateral elements - Simple problems using three noded triangular element only

TOTAL : 60

REFERENCE BOOKS :

1. Frank L. Stasa - Applied Finite Element Analysis for Engineers, CBS International Edition, 1985 SESHU
2. Reddy J.N. - A Introduction to Finite Element Method, McGraw Hill, International Edition, 1993
3. Krishnamoorthy C.S - Finite Element Analysis : Theory and Programming, Tata McGraw Hill Publishing Company .Ltd 1998
4. Rao.S.S, - Finite Element Method in Engineering, Pergamon Press, 1989
5. Cook,Robert Devis etal, - Concepts and Application of finite Element Analysis, Wiley John & Sons,1999
6. Buchaman,G - Schaum's Outline of finite Element Analysis, McGraw Hill Company

AU 310	NOISE, VIBRATION AND HARSHNESS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand NVH techniques adopted in automobile
- To learn NVH measurement techniques and legislation.
- To study the noise source identification techniques and their treatment

UNIT I INTRODUCTION TO AUTOMOTIVE NVH 9

Natural vibration of Single Degree of Freedom System (SDOF) and Multi Degree of Freedom System (MDOF), Undamped, damped and forced vibrations and Vibration of beams, plates & shells. Basics of sound propagation, Quantification of sound, Noise sources, generation and radiation, Pass-by noise limits, Automotive NVH sources, Interior noise of vehicles, Sound quality, Ride comfort, Noise and vibration control in vehicles.

UNIT II TRANSDUCERS AND MEASUREMENT TECHNIQUES 9

Transducers and exciters, Sound pressure, intensity and power measurement and Digital signal processing.

UNIT III NVH LEGISLATIONS 9

Psycho-acoustics and effect of noise on human beings, Ambient air quality standards, Noise specifications for automotive vehicles – pass-by & stationary and Noise specifications for generator sets, fire crackers and household articles.

UNIT IV NOISE SOURCE IDENTIFICATION TECHNIQUES 9

Frequency and order domain analysis, Sound intensity and sound power mapping and Introduction to array techniques - Acoustic holography & beam forming. Modal Analysis Definition of Modal Properties, Modal analysis theory, FE & Experimental modal analysis, Excitation sources, Applications of Modal Analysis

UNIT V PASSIVE NOISE TREATMENTS 9

A. Ducts & Mufflers -Types of mufflers, performance parameters – acoustics and backpressure, Reactive and absorptive silencers and Overall design considerations.

B. Acoustic Material Characterization -Sound transmission, absorption and damping, Behavior of acoustic material wrt sound absorption and transmission, Standard methods for evaluating sound absorption coefficient and transmission loss, Types of sound absorbers, Prediction of transmission loss and flanking transmission, Damping materials and their applications Interior Noise of Automobiles Interior noise sources, Structure borne noise, Airborne noise, Refinement techniques, Sound insulation

TOTAL: 60

REFERENCE BOOKS:

1. Theory of Vibrations with Applications: W T Thomson CBS Publishers Delhi
2. Mechanical Vibrations: S S Rao Addison-Wesley Publishing Co.
3. Fundamentals of Vibration : Leonard Meirovitch , McGraw Hill International Edison.
4. Principles of Vibration Control : Asok Kumar Mallik, Affiliated East- West Press.
5. Mechanical Vibrations A H Church ,John Wiley & Sons Inc
6. Mechanical Vibrations J P Den Hartog, McGraw Hill.
7. Mechanical Vibration Analysis: Srinivasan, McGraw Hill.
8. Mechanical Vibrations: G K Groover.
9. Vibration and Noise for Engineers: Kewal Pujara , Dhanpat Rai And co.

AU 311	ENGINE MANAGEMENT SYSTEMS AND EMISSION CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the principle of engines electronic management systems and different sensors used in the systems.
- To study the emission control techniques adopted in SI and CI engines.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines.

UNIT II SENSORS AND ACTUATORS 9

Inductive, Hall Effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

UNIT III SI ENGINE MANAGEMENT 9

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch Monojetronic, L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control.

UNIT IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valve.

UNIT IV CONTROL OF EMISSIONS FROM SI AND CI ENGINES 9

Design of engine, optimum selection of operating variables for control of emissions, EGR, Air injector PCV system, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control. NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles – USA, Japan, Euro and India. Test procedures – ECE, FTP Tests. SHED Test – chassis dynamometers, dilution tunnels.

TOTAL: 45

TEXT BOOKS

1. William B.Ribbens, Understanding Automotive Electronics, 5th Edition, Butterworth, Heinemann, 1998.
2. Tom Weather Jr and Cland C.Hunter, Automotive Computers and Control System, Prentice Hall Inc., New Jersey, 1984

REFERENCES

1. Diesel Engine Management by Robert Bosch, SAE Publications
2. Gasoline Engine Management by Robert Bosch, SAE Publications
3. Robert N Brady, “Automotive Computers and Digital Instrumentation”, A reston Book, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
4. Bechtold, “Understanding Automotive Electronics”, SAE, 1998.
5. T. Mellard, “Automotive Electronics System”, William Hienemann, London, 1987

AU 312 DESIGN OF AUTOMOTIVE COMPONENTS- II

L	T	P	C
3	1	0	4

OBJECTIVES:

- To design various automotive components.
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data.
- To learn to use catalogues and standard machine components .

UNIT I PRINCIPLES OF DESIGN OF THERMAL SYSTEMS 9

Principle of similitude, Thermodynamic analysis of reciprocating engine cycles, Engine cycle processes, Heat balance, Engine performance characteristics, General Engine Design: Selection of bore to stroke ratio, Cycle of operation, Speed, Number of cylinders and cylinder arrangements

UNIT II DESIGN OF PRINCIPAL ENGINE COMPONENTS 9

Design of piston, piston ring, piston pin, connecting rod, crankshaft, flywheel

UNIT III DESIGN OF VALVE GEAR TRAIN 9

Effect of valve timing on engine performance, Time selection of valve, Cam profile construction, Design of valve spring, Design of camshaft, Design of valve gear train for variable valve opening

UNIT IV ENGINE VIBRATIONS AND BALANCING 9

Dynamics of crank mechanism, Inertia forces, Torsion vibrations, Vibration damping, Engine balancing, Firing order, Cylinder arrangements for balancing.

UNIT V DESIGN OF ENGINE SYSTEMS 9

Design of cooling system, radiator, water pump and fan, Computation of air cooling system Design of fuel system for CI engine, Governor design, Design of carburetor, Design of direct cylinder and port injection system for SI engine, Design of intake and exhaust system Engine friction and wear, Selection of lubricant, lubricating system, pump and filters.

REFERENCES

1. I. C. Engine & Air Pollution – E. F. Obert, Harper & Row Publishers, NewYork
2. Engine Design – Giles J. G., Lliffe Book Ltd.
3. Engine Design – Crouse, Tata McGraw Publication, Delhi
4. I.C. Engine - Maleev V. L., McGraw Hill Book, Co.
5. I. C. Engine – L. C. Litchy, International Student Edition
6. Design of Automotive Engine – A. Kolchin and V. Demidov
7. I. C. Engine – Heywood
8. SAE Handbooks

AU 313 TWO WHEELER AND THREE WHEELERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the constructional details, operating characteristics and vehicle design aspects for two and three wheelers.
- To study the different components and their functions used in two and three wheelers.

UNIT I THE POWER UNIT **9**

Two stroke and four stroke SI engine, merits and demerits, Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes, merits and demerits, scavenging efficiency. Scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system. Electronic ignition System. Starting system. Kick starter system.

UNIT II CHASSIS AND SUB-SYSTEMS **8**

Main frame, its types. Chassis and shaft drive. Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

UNIT III BRAKES AND WHEELS **8**

Drum brakes, Disc brakes, Front and rear brake links lay-outs. Spoked wheel, cast wheel.Disc wheel. Disc types. Tyres and tubes.

UNIT IV TWO WHEELERS **10**

Case study of motor cycles, scooters and mopeds. Servicing and maintenance.

UNIT V THREE WHEELERS **10**

Case study of Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance.

TOTAL: 45

TEXT BOOK:

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
3. Bryaut, R.V., Vespa Maintenance and Repair series.
4. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

AU 314	FINITE ELEMENT ANALYSIS LAB FOR AUTOMOBILE APPLICATIONS	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn structural, thermal and modal analysis.
- To learn FEA applications in automobile industry.

LIST OF EXPERIMENTS:

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 2D component.
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixedends).
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.
11. Contact Analysis.
12. Strength analysis, Modal Analysis, Thermal Analysis, of Automotive Components like Engine, Gear Box, Exhaust, Brake, Bumper, Steering, and Differential systems.

AU 315	TWO AND THREE WHEELER LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand the construction and working two and three wheelers
- To diagnose the problems in two and three wheelers.
- To learn the servicing and maintenance of two and three wheelers.

List of Experiments

1. Dismantling and assembling of two stroke petrol engine and identification of parts.
2. Port timing diagram.
3. Decarbonising inspecting and replacing piston and connecting rod of two wheeler and three wheeler engine.
4. Servicing of Two Wheeler & Three Wheeler Carburetor.
5. Dismantling and assembling of four stroke Petrol engine and identification of parts.
6. Valve Timing diagram.
7. Removal of Wheels vulcanizing of tubes and refitting of wheels.
8. Identification of various components of ignition system and servicing of spark plug.
9. Dismantling inspection and reassembly of kick starter mechanism.
10. Dismantling inspection and testing of battery used in two and three wheeler.
11. Inspection of lighting system of two wheeler and its maintenance.
12. Inspection of lighting system of three wheeler and its maintenance.
13. Inspection of Auto Rickshaw Chassis and its maintenance.
14. Inspection of two wheeler chassis and its maintenance.
15. Maintenance schedule of Two Wheeler.
16. Maintenance Schedule of Three Wheeler.

AU 316 AUTOMOTIVE ELECTRONICS LABORATORY **L T P C**

0 0 2 1

OBJECTIVES:

- To perform the operations using logic gates, adders, flip flops and timers.
- To learn the working of microprocessor and microcontroller.
- To learn about interfacing and EPROM programming.

LIST OF EXPERIMENTS:

Study of the following devices for Automotive Application

1. Logic gates, Adders, Flip flops
2. SCR and IC Timers
3. Interfacing seven segment displays
4. Study of Microprocessor and Microcontrollers
5. Interfacing Sensors like RTD, LVDT, Load Cell etc.
6. Interfacing ADC for Data Acquistion
7. Interfacing DAC for Control Application
8. Interfacing Actuators
9. EPROM Programming
10. Mini Project

AU 317	STRUCTURE AND VIBRATION ANALYSIS LIBORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To perform structure and vibration analysis for different Automotive and mechanical components.
- To study and perform the sensitivity analysis for different types of governor.
- To learn the balancing of rotary and reciprocating automotive components.
- To determine of moment of inertia and centre of gravity for different automotive components.
- To analyze the different parameters of vibrating system like spring stiffness, damping coefficient, frequency and transmissibility ratio.

LIST OF EXPERIMENTS :

1. Study of dead weight governor- Determination of sensitivity and effort for Watt and Porter governors.
2. Comparative Study on of Dead Weight and Spring Loaded Governors - Performance characteristics of Proell and Hartnell governor.
3. Cam Analysis - Study of motion parameters and jump phenomenon of the cam.
4. Motorised Gyroscope-Verification of Gyroscopic Laws and Determination of gyroscopic couple.
5. Determination of critical speed of shaft under various end conditions.
6. Balancing of reciprocating masses.
7. Balancing of rotating masses.
8. Determination of Moment of inertia by oscillation method for connecting rod and flywheel.
9. Trifilar suspension for the determination of moment of inertia.
10. Determination of spring stiffness and equivalent stiffness.
11. Determination of damping co-efficient of single degree of freedom equivalent spring mass system.
12. Determination of influence coefficients for multi -degree freedom suspension system.

13. Determination of transmissibility ratio under Force Vibrations.
14. Determination of torsional frequencies for single and two rotor systems.
15. Determination of natural frequency for transverse vibration of a beam.
16. Determination of centre of gravity of components

SEMESTER VII

AU 401 AUTOMOTIVE MANUFACTURING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To study the automotive manufacturing techniques and its advancement.
- To learn the powder metallurgy techniques adopted for manufacturing of automotive components.
- To study the manufacturing process like forming and gear manufacturing.
- To learn the CNC machining technique and the recent manufacturing process adopted for automotive components.

UNIT I POWDER METALLURGY 8

Process flow chart – Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – Testing and inspection of PM parts.

UNITII FORMING PROCESS 10

Forging – process flow chart, forging of valves – connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydroforming: Process, hydroforming of manifold and comparison with conventional methods – Hydro forming of tail lamp housing. Stretch forming – Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

UNIT III GEAR MANUFACTURING 8

Different methods of Gear manufacture – Gear hobbing and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNIT IV CONCEPT & PROGRAMMING OF CNC MACHINES 9

NC, CNC & DNC – types of CNC – constructional features – drives and control systems feed back devices – manual part programming – steps involved – sample program in Lathe & milling.

UNIT V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS **6**

Powder injection moulding – Shotpeen hardening of gears – Production of aluminium MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminium composite brake rotors.

TOTAL :45

TEXT BOOK

1. Heldt,P.M., High Speed Combustion Engines, Oxford Publishing Co., New York, 1990.

REFERENCES

1. Haslehurst,S.E., Manufacturing Technology, ELBS, London, 1990.
2. Rusinoff, Forging and Forming of metals, D.B. Taraporevala Son & Co. Pvt.Ltd., Mumbai, 1995.
3. Subroff, A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, New York, 1988.
4. High Velocity Forming of Metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.
5. Groover. M.P., Automatic production systems and computer integrated manufacturing, Prentice-Hall, 1990.
6. GE Thyer, Computer Numerical Control of Machine Tools, BH.Newners, 1991.

AU 402 VEHICLE BODY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To learn the basic principles of aerodynamics for the design of vehicle body.
- To learn the design principles of carbody, busbody and LCV
- To study about the vehicle body materials, Trims and mechanisms.

UNIT I CAR BODY DETAILS 8

Types: saloon, convertibles, limousine, estate car, racing and sports car. Visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility and space in cars. Safety: safety design, safety equipments for cars. Car body construction; design criteria, prototype making, initial tests, crash tests on full scale model, Dummies and Instrumentation

UNIT II VEHICLE AERODYNAMICS 10

Objectives. Vehicle drag and types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, Various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments.

UNIT III BUS BODY DETAILS 8

Types: mini bus, single decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, seating dimensions. Constructional details: frame construction, double skin construction, types of metal sections used, Regulations, Conventional and integral type construction.

UNIT IV COMMERCIAL VEHICLE DETAILS 9

Types of body; flat platform, drop side, fixed side, tipper body, tanker body, Light commercial vehicle body types. Dimensions of driver's seat relation to controls. Drivers cab design.

UNIT V VEHICLE BODY MATERIALS, TRIM AND MECHANISMS 10

Steel sheet, timber, plastic, GRP, properties of materials; Corrosion, anticorrosion methods. Selection of paint and painting process. Body trim items. Body mechanisms.

TOTAL : 45

TEXT BOOK

1. J.Powloski - “Vehicle Body Engineering” - Business Books Ltd, London - 1989

REFERENCES

1. Giles.J.C. - “Body construction and design” - Liiffe Books Butterworth & Co. - 1971.

2. John Fenton - “Vehicle Body layout and analysis” - Mechanical Engg. Publication Ltd., London – 1982.

3. Braithwaite.J.B. - “Vehicle Body building and drawing” - Heinemann Educational Books Ltd., London – 1977.

AU 403	MODELLING AND SIMULATION OF VEHICLE SYSTEM	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To learn the modeling and simulation technique used in vehicle.
- To learn the ADAMS software and its application in vehicle dynamics.
- To learn the different types of FEA software and its automotive application.
- To gather knowledge on mathematical modeling technique adopted for vehicle systems.

UNIT I INTRODUCTION **9**

Introduction, fundamental principles. Vehicle tires performance, cornering characteristics Mechanics of Vehicle Terrain interaction. Introduction to Working Model 2D Tire model.

UNIT II VEHICLE KINEMATICS **9**

Vehicle Kinematics. Fundamental principles of velocity, acceleration. Two dimensional mechanisms. Forward Vehicle Dynamics Two dimensional mechanisms and vehicle analysis. Working Model 2D. Three dimensional Mechanisms. Multi-Body Systems Design. Introduction to 3D vehicle design Introduction to Vehicle Design using SOLIDWORKS. Mechanisms, Door, Auto Body. Introduction to NASTRAN4D

UNIT III SUSPENSION **9**

Suspension Design. Computer models using Bond Graph technology CAMP-G, MATLAB, SIMULINK, suspensions Simulations Vehicle vibrations principles. Seat Belt Design Mathematical Models Seat Belt, Bumper Design computer models. Drive train dynamics, vehicle performance, Computer models using CAMPG, MATLAB/SIMULINK

UNIT IV VEHICLE SYSTEM **9**

Steering Mechanisms. Two and three dimensional analysis. Mechanics of Vehicle Terrain interaction. Steering mechanisms analysis and design Working Model 2D, Nastran4D. Vehicle Collations. Fundamental laws of motion, energy and momentum Forces and Moments 2D and 3D Computer models for the calculations of impact forces. The Dynamics of vehicle rollovers Two and Three dimensional computer models of real situations.

UNIT V FEA **9**

Finite Element Modeling (FEA) and failure analysis Stress, deformation calculations. NASTRAN4D. Handling Characteristics of Road Vehicles Individual Groups Vehicle Design. Introduction to the ADAMS Vehicle Design Software Groups and Individual Vehicle Design Project

TOTAL:45

REFERENCES

1. Naim A. Kheir - "Systems Modeling and Computer Simulatio" - Marcel Dekker Inc. - 1996.
2. Hartmut Bossel – "Modeling and Simulation" -Volume 1
3. Michael Blundell, Damian Harty - "The Multibody Systems Approach to Vehicle Dynamics" Elsevier, 2004
4. Gui-Rong Liu, S. S. Quek, " The Finite Element Method:A Practical Course" - Butterworth-Heinemann, 2003

MS 481 MANAGEMENT CONCEPTS AND INDUSTRIAL RELATIONS **L T P C 3 0 0 3**

OBJECTIVES:

- To impart knowledge to the students in the principles of management
- To study about the Planning, Organizing, Staffing, Directing and Controlling.
- To learn about the industrial relations management.

UNIT I INTRODUCTION TO MANAGEMENT AND FORMS OF BUSINESS 9

Management: Definition, Nature and process of management - Functions of management, Levels of management - Management as Science or Art - Management vs Administration - Aproaches to management, Schools of thought and Contribution. Forms of business / Industrial ownership: Forms, Characteristics, Merits and demerits.

UNIT II PLANNING, ORGANISING AND STAFFING 9

Planning: Types of plans - Planning Process - Management by Objectives - Management by Exception - Decision making process. Organising: Purpose - Organizational Charts and Manual - Types of organization - Departmentation - Line and staff - Span of Control – Centralisation vs Decentralisation - Delegation. Staffing: Recruitment - Selection - Placement - Training - Performance appraisal.

UNIT III DIRECTING AND CONTROLLING 10

Directing - Meaning and Fundamentals of directing - Leadership: Definition, theories and styles - Motivation: Concepts, theories - Communicating: Types of communications - Process of Communication - Barriers - Effective Communication. Controlling - Objectives, System and Process of Controlling – Requirements for Effective Control -Types of control - Control Techniques.

UNIT IV CONTEMPORARY ASPECTS IN MANAGEMENT 7

Management By Exception, E-Commerce, Business Process Outsourcing, Business Process Reengineering, Lean organization, Just-in-time, Enterprise Resources Planning, Customer Relationship Management

UNIT V INDUSTRIAL RELATIONS AND LABOUR WELFARE 10

Trade Unions - Salient provisions of acts: Factories Act - Industrial Disputes

Act - Social Disablement Act - Employees State Insurance Act - Workmen's Compensation Act - Women workers and their welfare- Industrial disputes & strikes - causes and prevention - Machinery for settling disputes. Occupational Hazards - Accidents: causes and prevention - Safety Provisions - Safety education and training - Industrial health and hygiene

TOTAL : 45

REFERENCES :

1. Koontz, Weihrich and Aryasri "Essentials of Management", Tata McGraw - Hill, 2004
2. Tripathi P.C., and Reddy, P.N., "Principles of Management", Tata McGraw Hill Co., 2004
3. Prasad L.M, " Principles of Management", Sultan Chand & Sons, 2005
4. Mammoria C.B. and Sathish Mammoria, "Dynamics of Industrial Relations", Himalaya Publishing House, New Delhi, 1998.

AU 405	COMPUTER AIDED DESIGN AND MANUFACTURING LAB	L T P C 0 0 2 1

OBJECTIVES:

- To learn the different softwares used for CAD, CAM and its application in modeling and manufacturing.
- To understand and perform 3D part modeling by using different softwares like Pro/E, IDEAS, CATIA, UNIGRAPHICS and AutoCAD.
- To learn the programming technique used in CNC lathe and CNC milling.

LIST OF EXPERIMENTS

COMPUTER AIDED DESIGN

1. 3D Part modeling - protrusion, cut, sweep, draft, loft, blend, rib.
2. Editing - Move, Pattern, Mirror, Round, Chamfer.
3. Assembly - creating assembly from parts - assembly constraints.
4. Conversion of 3D solid model to 2D drawing - different views, sections,
5. isometric view and dimensioning.
6. Introduction to Surface Modeling.
7. Introduction to File Import, Export - DXF, IGES, STL, STEP.
8. 3D modeling of machine elements like Flanged coupling, screw jack etc.

Note : Any one of the 3D MODELING softwares like Pro/E, IDEAS, CATIA, UNIGRAPHICS, AutoCAD to be used.

COMPUTER AIDED MANUFACTURING

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

1. Part programming for Linear and Circular interpolation, Chamfering and Grooving.
2. Part programming using standard canned cycles for Turning, Facing, Taper turning and Thread cutting.

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

1. Part programming for Linear and Circular interpolation and Contour motions.
2. Part programming involving canned cycles for Drilling, Peck drilling, and Boring.

SIMULATION AND NC CODE GENERATION

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

TOTAL : 45

AU 406 VEHICLE MAINTENANCE AND RECONDITIONING LAB **L T P C**
0 0 3 1

OBJECTIVES:

- To understand and perform the operations like cylinder reboring, valve grinding and lapping.
- To learn the calibration of Fuel injection pump, engine tuning, wheel alignment, Brake bleeding, tinkering, soldering and battery testing.
- To perform clutch pedal play adjustment, wheel bearing adjustment, head light beam alignment and fitting of tyre.

LIST OF EXPERIEMENTS

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Cylinder reboring - checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines
7. Study and checking of wheel alignment - testing of camber, caster.
8. Testing kingpin inclination, toe-in and toe-out.
9. Brake adjustment and Brake bleeding.
10. Simple tinkering, soldeting works of body panels, study of door lock and window glass rising mechanisms.
11. Battery testing and maintenance.

Practice the following:

I. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play

II. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system

III. Wheel bearings tightening and adjustment

IV. Adjustment of head lights beam

V. Removal and fitting of tyre and tube

TOTAL:45

AU 407	MODELING AND SIMULATION LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn 3D vehicle design using SOLIDWORKS.
- To model and simulate the different vehicle systems like door, body and mechanisms.
- To study the drive train dynamics and principles of vehicle vibration.

LIST OF EXPERIMENTS

1. Two dimensional mechanisms.
2. Forward Vehicle Dynamics Two dimensional mechanisms and vehicle analysis.
3. Working Model 2D
4. Introduction to 3D vehicle design SOLIDWORKS.
5. Mechanisms, Door, Auto Body.
6. suspensions Simulations
7. Vehicle vibrations principles
8. Drive train dynamics
9. energy and momentum Forces and Moments 2D and 3D Computer models
10. Finite Element Modeling (FEA) and failure analysis Stress, deformation calculations

TOTAL:45

AU 408	MINOR PROJECT	L	T	P	C
		0	0	2	1

AIM:

To enable the students to apply their theoretical knowledge gathered in devised curriculum and to provide solution for real life problems.

OBJECTIVES:

- To define and identify the problem.
- To do literature survey related to the problem definition.
- To devise methodology, modeling for the chosen problem.
- To execute different solution for the objective and to select the optimal solution.
- To prepare a consolidated project report with all findings and conclusion.

TOTAL:45

SEMESTER VIII

AU 409 EVALUATION OF VEHICLE PERFORMANCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the performance of engine and transmission system in the vehicle.
- To learn and evaluate the different control systems like steering, suspension and braking.
- To study the procedure for different types of testing used for validating the vehicle design.

UNIT I VEHICLE PERFORMANCE **9**

Vehicle Performance Estimation & Prediction: Aerodynamic drag, methods of estimation of resistance to motion, power requirement for propulsion, Power plant characteristics & transmission related requirements, arrangement of power train, vehicle controls, vehicle acceleration, maximum speed, and gradiability drive systems comparison, hill climbing, handling and ride characteristics on different road surfaces.

UNIT II VEHICLE TRANSMISSION **9**

Vehicle Transmission Performance : Characteristics & features of friction clutches, mechanical gear transmission & Epicyclic gear boxes, fluid coupling & torque converters

UNIT III ENGINE PERFORMANCE **9**

Operational Performance : Engine performance & operating characteristics, Operation at full load and part load conditions, fuel economy, effect of vehicle condition, tire and road condition, traffic condition and driving habits on fuel economy, vehicle safety.

UNIT IV CONTROL SYSTEMS **9**

Control Systems: Braking arrangements & Characteristics, weight transfer, steering arrangements, rigid & independent suspension, roll centre, torsion bar, stabilizer, radius bar.

UNIT V TESTING AND VALIDATION **9**

Vehicle Performance Testing: Laboratory Testing – Testing of major components of vehicle like clutch, suspension, braking, steering etc., Engine

testing – noise, vibrations, emission, power & fuel consumption, Vehicle testing on chassis dynamometers, Road and Track Testing, Initial inspection, running in and durability, extensive driving, maximum speed & acceleration, Brake testing on the road, Hill climbing, handling & ride characteristics on different road surfaces, ride comfort, corrosion testing.

Term Work

1. Estimation of power requirement for vehicle propulsion
2. Engine testing for finding performance characteristic
3. On road fuel consumption measurement
4. Brake efficiency measurement
5. Noise measurement in passenger compartment
6. Vibration measurement in passenger compartment
7. Study of chassis dynamometer for vehicle performance testing
8. Study of vehicle component testing
9. Report based on visit to vehicle testing & research organization

TOTAL:45

REFERENCES

1. Gousha H. M., "Engine Performance Diagnosis & Tune Up Shop Manual"
2. J. G. Giles, "Vehicle Operation & Performance".
3. W. H. Crouse & D. L. Anglin, "Motor Vehicle Inspection".
4. SAE Transactions Papers – 831814 / 820346 / 820367 / 820371 / 820375
5. CIRT & VRDE Manuals

AU 410	COMPREHENSION	L	T	P	C
		0	0	2	1

AIM:

To assess the technical knowledge gathered by a student during the entire course of study.

OBJECTIVES:

- To assess the theoretical and practical knowledge of a student.
- To assess the knowledge gathered by a student during the industrial visits/ seminars.
- To evaluate the students performance and to make him to meet the industry/ academic requirements.

TOTAL:45

AU 411	PROJECT WORK	L	T	P	C
		0	0	12	6

AIM:

To enable the students to apply their knowledge to provide an innovative solution for real life complicated problems.

OBJECTIVES:

- To do the research on a specified area and to find a solution for the defined objective.
- To publish the findings in international /national conferences in form of research paper.
- To prepare a consolidated project report with all findings and conclusion.

TOTAL:45

ELECTIVES

AUX 001 AUTOMOTIVE SAFETY SYSTEMS

L	T	P	C
3	0	0	3

AIM:

The course aims at imparting knowledge about automotive safety systems and safety equipments.

OBJECTIVES:

- To design the vehicle body for safety and to understand the concept of crumble zone.
- To realize the deformation behavior of vehicle body on impact with different types of obstacles.
- To study the working of safety equipments like airbags, collision warning system, and seat belt used in vehicles.
- To understand the working of comfort and convenience system.

UNIT I INTRODUCTION **9**

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

UNIT II SAFETY CONCEPTS **9**

Active safety: driving safety, conditional safety, perceptibility safety, operating safetypassive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT III SAFETY EQUIPMENTS **9**

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

UNIT IV COLLISION WARNING AND AVOIDANCE **9**

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

UNIT V COMFORT AND CONVENIENCE SYSTEM 9

Steering and mirror adjustment, central locking system , Garage door opening system, tyre pressure control system, rain sensor system, environment information system

TOTAL : 45

TEXT BOOK

1. Bosch - “Automotive Handbook” - 5th edition - SAE publication - 2000.

REFERENCES

1. J.Powloski - “Vehicle Body Engineering” - Business books limited, London - 1969.
2. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., - 1999.

AUX 002 FUELS AND LUBRICANTS L T P C
3 0 0 3

AIM:

The course is devised to understand the properties of fuels and lubricants for the design and operation of the I.C engines.

OBJECTIVES:

- To understand the manufacturing processes of fuels and lubricants.
- To study the fuel properties, combustion phenomenon, fuel rating and testing standards of fuels.
- To understand the theory of lubrication and its types.

UNIT-I MANUFACTURE OF FUELS AND LUBRICANTS 9

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT-II THEORY OF LUBRICATION 9

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT- III LUBRICANTS 9

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

UNIT-1V PROPERTIES AND TESTING OF FUELS 9

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, distillation, vapour pressure, flash point, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point etc.

UNIT-V COMBUSTION & FUEL RATING 9

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives specifications of fuels.

TOTAL : 45

TEXT BOOKS

1. Ganesan.V., “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur, R.P.Sharma “A course in internal combustion engines”, Dhanpatrai publication, 2003.
3. Obert.E.F “Internal Combustion Engineering and Air Pollution”, International book Co., 1988.

REFERENCES

1. Brame, J.S.S. and King, J.G. – Fuels – Solids, Liquids, Gaseous.
2. Francis, W – Fuels and Fuel Technology, Vol. I & II
3. Hobson, G.D. & Pohl.W- Modern Petroleum Technology
4. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press – 1982.
5. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.

AUX 003 ELECTRIC AND HYBRID VEHICLE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the hybrid vehicle design, architecture and its specification.
- To study the electric drives and its types.

UNIT I HYBRID VEHICLES **9**

Performance characteristics of road vehicles, calculation of road load, predicting fuel economy, Grid connected hybrids. DC motors-series wound, shunt wound. Compound wound and separately excited motors AC motors - induction, synchronous, brushless DC motor, switched reluctance motors.

UNIT II HYBRID ARCHITECTURE **9**

Series configuration- locomotive drives, series parallel switching, load tracking architecture. Pre transmission parallel and combined configurations-Mild hybrid, power assist, dual mode, power split, power split with shift, Continuously Variable transmission (CVT). Wheel motors.

UNIT III HYBRID POWER PLANT SPECIFICATIONS **9**

Grade and cruise targets. launching and boosting, braking and energy recuperation, drive cycle implications, engine fraction-engine downsizing and range and performance, usage requirements.

UNIT IV SIZING THE DRIVE SYSTEM **9**

Matching electric drive and ICE, sizing the propulsion motor, sizing power electronics. Battery basics, lead-acid battery, different types of batteries, battery parameters.

UNIT V ELECTRIC DRIVES **9**

Early Ward Leonard control system - main features, generator, merits, reverse motion, modified WARD LEONARD control system - main features, modifications. Modern electric drives - main features, advantages of electric drives, limitations of electric drive, variations of torque and speed with armature current Generator, motor, series motor, variations of efficiency with armature current.

TOTAL :45

TEXT BOOKS

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi., “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles”, Fundamentals, Theory, and Design, CRC Press 2009.

2. Ron Hodkinson and John Fenton, “Lightweight Electric/Hybrid Vehicle “, Butterworth - Heinemann, 2001.

REFERENCES

1. James Larminie and John Loury, “ Electric Vehicle Technology –Explained”, John Wiley & Sons.

2. Ronald K Jurgen, “Electric and Hybrid –Electric Vehicles”, SAE, 2002.

3 Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth – Heinemann,2002.

AUX 004 **LEAN AND SIX SIGMA** **L T P C**
3 0 0 3

AIM:

To Study the lean and six sigma manufacturing concepts followed in the industry.

OBJECTIVES:

- To give an overview of lean manufacturing and its evolution.
- To understand the design of value stream management.
- To understand the concepts like pokayoke, lean metrics, lean sustenance, six sigma and DMAIC tools.

UNIT I LEAN MANUFACTURING AND SIX SIGMA – OVERVIEW 5

Evolution of Lean; Traditional versus Lean Manufacturing; Business of Survival and Growth; Business Model Transformation; Ford Production System; Job Shop Concepts Concept of Lean; Toyota's foray in Lean.

UNIT II DESIGN - VALUE STREAM MANAGEMENT 10

Definition; VSM Types; Product Family Selection; Value Stream Manager; Current State Map; Process Box; Value Stream Icons; 3 Ms - Muda, Mura, Muri - 7 Types of Muda; Future StateMap;Value Stream Plan; Process Stability - Loss Reduction 7 Major Losses Reduction. Demand Stage :Market Dynamics; Customer Demand; PQ Analysis; PR Analysis; TAKT Time; Pitch; Finished Goods Stock; Cycle Stock; Buffer Stock; Safety Stock.

UNIT III SYSTEM IMPLEMENTATION: 12

Flow Stage : Continuous Flow; Cell Layout; Line Balancing; Macro and Micro Motion Analysis; Standardized Work; Concept of Kaizen; Steps involved in Kaizen Deployment; Industrial Engineering - Concepts and Fundamentals; Kanban Concepts ; Types of Kanbans; and Practical Application ; Concept of Pull; Changeover Time Reduction - External & Internal, Single Minute Exchange of Die; Quick Die Change; Quality-Vendor, In Process and Customer Line ; Concept of PPM; Pokayoke; Prevention & Detection Types; Maintenance - Preventive, Time Based and Condition Based; Human Development for Lean (Training and Involvement through Autonomous Maintenance) Leveling Stage of Lean Implementation : Production Leveling ; Leveling Box; Concept of Water Spider.

UNIT IV LEAN METRICS AND LEAN SUSTENANCE 7

Identify Lean Metrics; Steps involved in Goal Setting; Corporate Goals; Kaizen Cloud identification in VSM; Lean Assessment. Cultural Change; Reviews; Recognition; Improving Targets and Benchmarks.

UNIT V SIX SIGMA AND DMAIC TOOLS: 10

Project charter, stakeholder analysis, SIPOC, Voice of the customer, Rolled throughput yield, KANO Models, CTQ Tree, Process Mapping Data collection, measurement system analysis ,sampling plans, process capability, cost of poor quality (COPQ), FMEA Regression Analysis ,cause & effect diagram, Hypothesis testing, Design of experiments, Response Surface methodology, Poka-yoke, Quality Control, Control charts.

TOTAL : 44

REFERENCES:

1 Keki R. Bhote, “The ultimate six sigma”, Prentice hall India.

2 Rath & Strong’s Six sigma pocket guide.

3 Don Tapping, Tom Luyster and Tom Shuker, “Value Stream Management” Productivity Press, 2002.

4 Tom Luyster and Don Tapping, “Creating Your Lean Future State: How to Move from Seeing to Doing”, Productivity Press, 2006.

5 Mike Rother and Rick Harris, “Creating Continuous Flow”, Publisher: Lean Enterprise Institute, Inc., 2001.

6 Rick Harris, Chris Harris & Earl Wilson, “Making Materials Flow”, Publisher: Lean Enterprise Institute, Inc., 2003.

AUX 005	ALTERNATIVE ENERGY FOR AUTOMOTIVE APPLICATION	L	T	P	C
		3	0	0	3

AIM:

To Study and identify the alternative energy for the Automotive applications.

OBJECTIVES:

- To acquire knowledge of alternate fuels and the changes in the engine design for handling them and understand various energy systems for use in the automobiles.

UNIT I INTRODUCTION **6**

Estimation of petroleum reserve "World Energy Scenerio, Energy Survey of India" – Need for alternate fuel – Availability of alternate fuels.

UNIT II ALCOHOLS **9**

Properties as engine fuels, alcohols and gasoline blends, performance in SI engine. Methanol and gasoline blends – Combustion characteristics in engines – emission characteristics.

UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS **9**

Availability of CNG, properties, modification required to use in engines – performance and emission characteristics of CNG and LPG in SI & CI engines. Performance and emission for LPG – Hydrogen – Storage and handling, performance and safety aspects.

UNIT IV VEGETABLE OILS **10**

Various vegetable oils for engines – Esterification – Performance in engines – Performance and emission characteristics.

UNIT V ELECTRIC AND SOLAR POWERED VEHICLES **11**

Layout of an electric vehicle – advantage and limitations – Specifications – System component, Electronic control system – High energy and power density batteies – Hybrid vehicle – Solar powered vehicles. Fuel cell vehicles.

TOTAL:45

TEXTBOOK

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Maheswar Dayal, Energy today & tomorrow, I & B Horishr India, 1982.
3. Bechtold,R.L., Alternative Fuels Guide Book, SAE, 1997.

REFERENCES

1. Nagpal, Power Plant Engineering, Khanna Publishers, 1991.
2. Alcohols and motor fuels progress in technology, Series No.19, SAE Publication USA 1980.
3. SAE Paper Nos.840367, 841156, 841333, 841334.
4. The properties and performance of modern alternate fuels – SAE Paper No.841210.

AUX 006 ADVANCED I.C. ENGINES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the combustion modeling and Fuel combustion.
- To study the usage of non conventional IC engines.

UNIT I INTRODUCTION **7**

Fuel air cycle and Actual cycle analysis, Properties of IC engine fuels, Refining process, chemical composition and molecular structure of fuels, octane number, cetane number. Knock rating of SI engine fuels.

UNIT II COMBUSTION OF FUELS **12**

Combustion Stoichiometry of petrol, diesel, alcohol and hydrogen fuels – Chemical energy and heating values – Chemical equilibrium and maximum temperature – SI engine combustion – Flame velocity and area of flame front –performance number – CI engine combustion. Fuel spray characteristics – droplet size, penetration and atomization.

UNIT III COMBUSTION MODELLING **10**

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 NON-CONVENTIONAL IC ENGINES **8**

Adiabatic and L.H.R. engines – Variable compression ratio engine – Wankel rotary combustion engine – Free piston engine - MAN combustion chamber and multi fuel engines – Stratified charge and lean burn engines – Locomotive and marine engines.

UNIT V COMBUSTION ANALYSIS IN IC ENGINES **8**

Photographic studies of combustion processes – P- diagrams in SI and CI engines, Rate of heat release – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines

TOTAL:45

TEXT BOOKS

1. Ganesan .V - “IC Engines” - Tata McGraw-Hill, 2003.

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’ - UniversitiesProcess Ltd, Hyderabad - 1993.

2. Ganesan.V. – Computer Simulation of compression ignition engines – OrcentLongman – 2000.

3. Richard Stone – “Introduction to IC Engines” – 2nd edition – Macmilan – 1992.

AUX 007 NEWER MATERIALS FOR AUTOMOBILES **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the characteristics of various, processing techniques composite materials and its applications in automotive industry.

UNIT I INTRODUCTION **9**

Reinforcement – Fibres – Glass fibre, Aramid fibre, Carbon fibre, boron fibre – Fabrication – Properties – Applications – Comparison of fibres – Particulate and whisker reinforcements. Matrix materials – Properties-Wettability – Effect of surface roughness – Interfacial bonding – Methods for measuring bond strength.

UNIT II POLYMER MATRIX COMPOSITES **9**

Polymer Matrix Composites -Types – Processing – Thermal matrix composites – Hand layup and spray technique, filament winding, Pultrution, resin transfer moulding, autoclave molding – Thermoplastic matrix composites – Injection molding, film stacking – Diaphragm forming – Thermoplastic tape laying. Glass fibre/polymer interface. Mechanical properties – Fracture. Applications.

UNIT III METAL AND CERAMIC MATRIX COMPOSITES **9**

Metal Matrix Composites Types. Important metallic matrices. Processing – Solid state, liquid state, deposition, Mechanical properties. Applications.

Ceramic matrix materials – Processing – Hot pressing, liquid infiltration technique, Lanxide process, insitu chemical reaction techniques – CVD, CVI, sol gel process. Interface in CMCs. Mechanical properties – Thermal shock resistance – Applications.

UNIT IV COMPOSITE STRUCTURES **9**

Fatigue – S-N curves – Fatigue behaviors of CMCs – Fatigue of particle and whisker reinforced composites – Hybrid composites – Thermal fatigue – Creep

Introduction to structures - selection of material, manufacturing and laminate configuration -design of joints - bonded joints - bolted joints - bonded and bolted – laminate optimization.

UNIT V AUTOMOTIVE APPLICATIONS **9**

Drive Shafts, Suspension Arms, Wheels, Valve Guides, Clutch Plates, use of MMC in disc brakes, Mufflers and other applications

TOTAL : 45

REFERENCES:

1. Mathews F L and Rawlings R D, “Composite Materials: Engineering and Science”, CRC Press and Woodhead Publishing Limited, 2002.
2. Krishnan K Chawla, “Composite Materials Science and Engineering”, Springer, 2001.
3. Handbook of Composites – American Society of Metals, 1990.
4. Derek Hull, “An introduction to Composite Materials”, Cambridge University Press, 1988.

AUX 008 VEHICLE COMFORT SYSTEM & ERGONOMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the engineering principles that underpin the design of an automotive vehicle for the comfort of the occupants and other road users.
- Recognize the future direction of the design of comfort systems within the automotive engineering sector.
- Appreciate the role and use of comfort systems in automobile engineering.

UNIT I INTRODUCTION TO AUTOMOTIVE COMFORT SYSTEMS 14

Introduction to automotive comfort systems for both the vehicle occupants and other road users. Introduction to the design, construction and operation of comfort systems such as: NVH (noise, vibration and harshness) of chassis, engines and power train, ride quality and sound quality; heating, ventilation and air conditioning systems.

UNIT II DRIVER COMFORT 10

Driver comfort – seating, visibility, man-machine system, Psychological factors – stress, attention

UNIT III PASSENGER COMFORT 10

Passenger comfort - Ingress and egress, spaciousness, ventilation, temperature control, dust and fume prevention and vibration.

UNIT IV COMFORT AND CONVENIENCE SYSTEM 10

Steering and mirror adjustment – Central locking system – Garage door opening system – Tyre pressure control system – Rain sensor system – Environment information system

UNIT V VEHICLE ERGNOMICS 10

Introduction to human body, Anthropometrics and its application to vehicle ergonomics and cockpit design. Ergonomic research methods / ergonomic audit, Practical work aimed at integrating design and ergonomics

TOTAL : 54

REFERENCES:

1. B.Peacock, Waldemar Karwowski; Automobile ergonomics. Publisher: CRC; 1 edition, 1993
2. Bosch, “Automotive Handbook”, 5th Edition, SAE publication, 2000.
3. Ronald.K.Jurgen, “Automotive Electronics Handbook”, 2nd Edition, McGraw-Hill Inc.,1999.

AUX 009 INTELLIGENT VEHICLE SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about the intelligent vehicle systems and development.
- To learn vehicle recent control systems and navigation systems.

UNIT I VEHICLES SYSTEMS **9**

Constantly Variable Transmission, Benefits, Brake by wire, Advantages over power Braking System. Electrical assist steering, Steering by wire, Advantages of Steering by wire.

UNIT II BODY CONTROL SYSTEMS **9**

Semi-active and fully-active suspension system. Advantages of fully active suspension system. Radar guided breaks. Radar guided lane assist. GPS

UNIT III ENGINE SYSTEMS **9**

Integrated Starter Alternator: Starts stop operation, Power Assist, Regenerative Braking. Advanced lead acid batteries, Alkaline batteries, Lithium batteries, Development of new energy storage systems, Deep discharge and rapid charging ultra capacitors.

UNIT IV X-BY WIRE TECHNOLOGY **9**

What is X-By Wire, Advantage over hydraulic systems. Use of Automotive micro controllers. Types of Sensors. Use of actuators in an automobile environment.

UNIT V ADVANCED SYSTEMS **9**

Driver sleep prevention. Anti theft and reporting. Collision avoidance system. Park assisted system, pedestrian/cyclist collision warning system, real-time engine calibration based on driver behavior, next-generation fuel injectors, Lightweight, ultra-durable automotive brake rotor, lectrical brushless diesel fuel pump

TOTAL : 45

REFERENCE:

1. SAE technical papers, Patents, Magazines, webinars and other recent technology forum in website.

AUX 010 FUEL CELLS TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

To lawn Fundamentals of fuel cells technology and its application in automobiles.

UNIT I INTRODUCTION TO FUEL CELLS 9

Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

UNIT II FUEL CELLS FOR AUTOMOTIVE APPLICATIONS 9

Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market.

UNIT III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE 9

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

UNIT IV FUELING 9

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

UNIT V FUEL CYCLE ANALYSIS 9

Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engine fueled by natural gas and hydrogen and hybrid electric vehicle.

TOTAL: 45

TEXTBOOKS

1. Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-86058 4233, 2004.

2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003

AUX 011 SIMULATION OF IC ENGINES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the simulation techniques for both SI and CI engines.

UNIT I INTRODUCTION **9**

Introduction-Heat of reaction-Measurement of URP-Measurement of HRP-Adiabatic flame temperature, complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature-Isentropic changes of state.

UNIT II SI ENGINE SIMULATION WITH AIR AS WORKING MEDIUM **9**

Deviation between actual and ideal cycle-Problems, IC engine simulation with adiabatic combustion, temperature drop due to fuel vaporization, full throttle operation-efficiency calculation, part-throttle operation, super charged operation

UNIT III PROGRESSIVE COMBUSTION **9**

SI Engines simulation with progressive combustion with gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram and other engine performance.

UNIT IV SIMULATION OF CI ENGINE: **9**

Diesel Engine Simulation: Multi Zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, and simulation for pollution estimation.

UNIT V SIMULATION OF NEW ENGINE CONCEPTS **9**

Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine, controlled auto ignition engine.

References:

1. Ganesan. V. Computer Simulation of spark ignition engine process, Universities Press (I) Ltd. Hyderabad, 1996.
2. Ramoss. A.L., Modelling of Internal Combustion Engines Processes, McGraw Hill Publishing Co., 1992.

3. Ashley Campbel, Thermodynamic analysis of combustion engines, John Wiley & Sons, New York, 1986

4. Benson. R.S., Whitehouse. N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

AUX 012 OFF ROAD VEHICLES L T P C
3 0 0 3

OBJECTIVES:

- To understand the working off - road vehicles, land clearing machines, earth moving machines, scarpers, shovels and ditchers.

UNIT – I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 8

Power plants, chassis and transmission, Multiaxle vehicles.

UNIT – II LAND CLEARING MACHINES 6

Bush cutter, stampers, Tree dozer, Rippers.

UNIT – III EARTH MOVING MACHINES 10

Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines.

UNIT – IV SCRAPERS AND GRADERS 9

Scrapers, elevating graders, self powered scrapers and graders.

UNIT – V SHOVELS AND DITCHERS 12

Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

TOTAL: 45

REFERENCES:

1. Abrosimov. K. Bran berg.A. and Katayer.K., "Road making Machinery ", MIR Publishers, Moscow, 1971.
2. Wang.J.T., " Theory of Grand vehicles", John Wiley & Sons, New York, 1987.
3. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998

AUX 013 SURFACE ENGINEERING & HEAT TREATMENT

L	T	P	C
3	0	0	3

AIM:

To provide knowledge of principle and practice of surface engineering and coating techniques

OBJECTIVES

- To understand the various surface finishing processes like tribology, plating, hardfacing and coatings.

UNIT – I TRIBOLOGY AND PLATING PROCESSES 10

Introduction to tribology, Wear: Types of wear - adhesive, abrasive, oxidative, corrosive, erosive and fretting wear, roles of friction and lubrication and wear testing.Plating Processes: Fundamentals of electrodeposition, plating of nickel, chromium, tin and copper, pulsed plating, hydrogen embrittlement, plating adhesion, electroless plating, electrochemical conversion coating, selective plating for repair, plating properties, hard anodizing.

UNIT – II HARDFACING PROCESSES 10

SMAW, GTAW, GMAW, FCAW, SAW, PAW, Oxy-Acetylene Welding, Furnace fusing, Thermal -spray, flame spray processes - HVOF, Detonation gun and jet kote processes, hard facing consumables.

UNIT–III SPECIAL DIFFUSION PROCESSES 7

Principle of diffusion processes – Boriding, Aluminising, Siliconising, Chromising, Sursulf - Selection of diffusion processes – Characteristics of diffused layer – micro structure and micro hardness evaluation – properties and applications.

UNIT- IV THIN FILM COATINGS 8

Physical vapour deposition processes – Thermal evaporation - sputter coating - Ion plating – Chemical vapour deposition – reactive sputtering - TiC, TiN, Alumina, CBN, Diamond and DLC coatings. Structure, properties and applications.

UNIT- V HIGH ENERGY MODIFICATION AND SPECIAL PROCESSES 10

Electron beam hardening/ glazing, Laser beam hardening / glazing ion inplantation, Composite surface created by laser and Electron beam. Surface

cements, Wear tiles, Electro spark deposition, fused carbide cloth, thermal / chemical,Ceramic coatings, centrifugal cast wear coatings, Wear sleeves and Wear plates.

TOTAL : 45

REFERENCES:

1. ASM Handbook "Surface Engineering", Volume 5, ASM International, 1994 - 1039 pages
2. Tadeusz Burakowski, Warszawa, Tadeusz Wierzchon, "Surface Engineering of Metals: Principles, Equipment, Technologies" -1998 CRC Press
3. ASM Handbook "Heat Treating", Volume 4, ASM International, 1991 -1012 pages
4. T. V. Rajan, C. P. Sharma, Ashok Sharma, "Heat Treatment"-Principles and Techniques, PHI Learning Pvt. Ltd.,2004

AUX 014	ADVANCED MATERIAL TESTING AND FAILURE ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Material Testing, Matenal characterization, Instrumental techniques and failure analysis.

UNIT I MATERIAL PROPERITES **10**

Mechanical Characterization: Mechanical Property characterization- Principles & characterization techniques related to tensile, compressive, hardness, fatigue, and fracture toughness properties. Deformation, Super plasticity Stress-strain diagram, Determination of YS, UTS, MoE, %E, %RA, Hardness testing, true stress-strain diagram, stretcher strain characteristics, effects of cold working, & n values, poisons ratio

UNIT II MECHANICAL TESTS **10**

Deep drawn quality of sheets, Impact test, bend test, shear test, Significances of property evaluation, SN curves and fatigue life, non-destructive testing, residual stress measurements, microscopy and scanning electron microscopy, EDAX / WDS analysis, corrosion testing, wear & tear characteristics, slow strain rate characteristics, thermal behaviors. Thermal Analysis: Principles and applications of thermal analysis.

UNIT III PROPERTIES OF PLASTICS, ELASTOMERS AND COMPOSITES **10**

Molecular weight distribution, MFI, HDT & VICAT softening point, cold temperature behaviors, Rheological behaviors, hardness and impact properties, identification of polymers, weathering characteristics, cyclic temperature test, flammability, VOC and odor test, scratch resistance test, metal composition analysis, ROHS analysis

UNIT IV MATERIAL BEHAVIOURS **10**

Electrical properties of Materials – Dielectric constant, electrical resistivity, coefficient of thermal expansion & contraction, wire harness test Mechanical behaviors, Thermal response, Fire retardancy, Chemical resistance and Electrical-Magnetic-Optical properties of ploymer nano-composites.

UNIT V INSTRUMENTAL TECHNIQUES **10**

FTIR spectrometer, Thermal analyzer, X-ray analyzer, Optical emission spectroscopy, Ion Chromatography, Gas and Liquid Chromatography, High

strain rate tester, Non-destructive instruments, etc. New innovations in testing and characterization, X-ray Diffraction, Electron microscope (SEM, TEM), Scanning probe microscopy (SPM, AFM), Spectroscopic methods (EDS, FTIR); Mechanical behaviors, Thermal response, Fire retardancy, Chemical resistance and Electrical-Magnetic-Optical properties of ploymer nano-composites.

TOTAL:50

TEXT BOOKS:

1. Dictionary of Materials and Testing, Second Edition by Joan Tomsic

REFERENCES:

1. Material Characterization: Introduction to Microscopic & Spectroscopic Methods by Yang Leng John Wiley & Sons (Asia) Pte Ltd.
2. ASM Handbook on Metals Handbook: Vol. 8 Mechanical Testing – 1978.

AUX 015 TRACTOR AND AGRICULTURAL MACHINES **L T P C**
3 0 0 3

OBJECTIVE:

- To learn about tractors and farm equipments.

UNIT I GENERAL DESIGN OF TRACTORS **10**

Classification of tractors – Main components of tractor – Safety rules.

UNIT II TRACTOR CONTROL AND FUNDAMENTALS OF ENGINE OPERATION **10**

Tractor controls and the starting of the tractor engines – Basic notions and definition – Engine cycles – Operation of multicylinder engines – General engine design – Basic engine performance characteristics.

UNIT III ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR **10**

Cylinder and pistons – Connecting rods and crankshafts – Engine balancing – Construction and operation of the valve mechanism – Valve mechanism troubles.

UNIT IV COOLING SYSTEM, LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR **10**

Cooling system – Classification – Liquid cooling system – Components, Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters – Fuel pumps.

UNIT V FARM EQUIPMENTS **5**

Working attachment of tractors – Farm equipment – Classification – Auxiliary equipment – Trailers and body tipping mechanism.

TOTAL:45

TEXTBOOK

1. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.

REFERENCES

1. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor
2. MIR Publishers, 1972.

AUX 016 FLEET MAINTENANCE AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the principle of fleet maintenance and management.
- To learn about vehicle maintenance, parts supply.
- To learn about the rules and regulation of motor vehicle act

UNIT I MANAGEMENT TRAINING AND OPERATIONS 10

Basic principles of supervising. Organising time and people. Job instruction training – Training devices and techniques – Drive and mechanic hiring – Driver checklist – Lists for driver and mechanic – Trip leasing – Vehicle operation and types of operation.

UNIT II VEHICLE MAINTENANCE 8

Scheduled and unscheduled maintenance – Planning and scope – Evaluation of PMI programme – Work scheduling – Overtime – Breakdown analysis – Control of repair backlogs – Cost of options.

UNIT III VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET 10

Cost of inventory – Balancing inventory cost against downtime – Parts control – Bin tag systems – Time management – Time record keeping – Budget activity – Capital expenditures – Classification of vehicle expenses – Fleet management and data processing – Data processing systems – Software. Models – Computer controlling of fleet activity – Energy management.

UNIT IV SCHEDULING AND FARE STRUCTURE 10

Route planning – Scheduling of transport vehicles – Preparation of timetable, Costs, fare structure – Methods of fare collection – Preparation of fare table.

UNIT V MOTOR VEHICLE ACT 7

Schedules and sections – Registration of motor vehicles – Licensing of drivers – Control of permits – Limits of speed – traffic signs–Constructional regulations–Description of goods carrier, delivery man, tanker, tipper, Municipal, fire fighting and break down service vehicle.

TOTAL:45

TEXT BOOK

1. John Dolu, Fleet management, McGraw Hill Co., 1984.

REFERENCES

1. Government Publication, The Motor vehicle Act, 1989.
2. Kitchin,L.D., Bus operation, Illiffe and Sons Ltd., London, III Edition, 1992.
3. Kadiyali,L.R., Traffic engineering and Transport Planning.

ME 303 APPLIED HYDRAULICS AND PNEUMATICS **L T P C**
3 0 0 3

OBJECTIVES:

- To understand working of Hydraulic systems and components.
- To learn about the working of pneumatic systems components and pneumatic circuits.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advant ages 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 Pascals Law- Laminar and Turbulent flow - Reynold's 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 tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators - Fluid motors, Gear, Vane and Piston motors. 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.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Reciprocation, quick return, sequencing, synchronizing circuits, simple industrial circuits- press circuits, earth movers, grinding machines. safety and emergency modules. 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, Pneumo hydraulic circuit, Sequential circuit design forsimple industrial 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 BOOKS :

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

REFERENCES :

1. Majumdar S.R., "Pneumatic systems - Principles and maintenance", Tata McGraw Hill, 1995
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. Dudely A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

ME 311 COMPUTER AIDED DESIGN AND MANUFACTURING **L T P C**
3 0 0 3

OBJECTIVE:

- To learn about modeling and manufacturing techniques using CAD/CAM software.
- To learn about the working of Flexible Manufacturing Systems and Group Technology.

UNIT I INTRODUCTION **9**

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices. Computer Graphics: Raster scans graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, and hidden surface removal.

UNIT II GEOMETRIC MODELING **9**

Geometric modeling: Requirements, geometric models, geometric construction models,curve representation methods, surface representation methods, modeling facilities desired. Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling, constraint based modeling.

UNIT III COMPUTER AIDED MANUFACTURING **9**

Numerical control, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT IV COMPUTER AIDED PRODUCTION PLANNING GROUP TECHNOLOGY **9**

Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type. Material requirement planning, manufacturing resources planning.

UNIT V FLEXIBLE MANUFACTURING SYSTEMS **9**

DNC, AGV, ASRS, Flexible manufacturing systems - FMS equipment, system

layouts, FMS control.CIM: Integration, CIM implementation, major functions in CIM, Benefits of CIM, Lean manufacturing, Just-in-time.

TOTAL : 45

TEXT BOOK :

1. CAD / CAM Principles and Applications - 2nd edition, P.N. Rao, Tata Mc. Graw Hill

REFERENCES:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
2. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
3. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
4. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.

MEX 002 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM:

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve total quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality – Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000- ISO 9000-2000 Quality System–Elements, Documentation,Quality auditing-QS 9000 – ISO 14000 –Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL : 45

TEXT BOOK

1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCE BOOKS

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

MEX 008 PROCESS PLANNING AND COST ESTIMATION **L T P C**
3 0 0 3

OBJECTIVE:

- To learn process planning activities carried out in a industry.
- To learn cost estimation technique followed in industry.

UNIT I 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 – CAPP – Retrieval and generative type.

UNIT II COMPUTER AIDED PROCESS PLANNING **10**

Computer Aided Process Planning - Variant process planning - Generative process planning - Forward and backward planning, Logical Design of Process Planning - Implementation considerations -manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP

UNIT III INTRODUCTION TO COST ESTIMATION **7**

Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost- Material cost-Determination of material cost-Labour cost- Determination of labour cost - Expenses-Ladder of cost - Analysis of overhead expenses-Factory expenses – Depreciation - causes of deprecation – Methods of depreciation – Administrative Expenses – Selling Price Calculation.

UNIT IV PRODUCTION COST ESTIMATION **8**

Estimation in Forging shop – Losses in Forging – Forging cost – Estimation in welding shop – Gas cutting – Electric arc welding – Estimation in Foundry shop – Estimation of pattern cost and casting cost.

UNIT V ESTIMATION OF MACHINE TIME AND COST **10**

Estimation of machining time for lathe operation – estimation machining time for drilling, boring, shaping, planning milling and grinding operations.

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, 9th Edition, 1998

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, 2002.

MEX 009 MICRO ELECTRO MECHANICAL SYSTEMS (MEMS) **L T P C 3 0 0 3**

OBJECTIVE:

- To gain Fundamental understanding of micro electro mechanical systems (MEMS).
- To learn MEMS design and Electrostatic design.
- To learn the design of optical MEMS and RF MEMS.

UNIT I INTRODUCTION TO MEMS **9**

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Microaccelorometers and Micro fluidics, MEMS materials, Micro fabrication

UNIT II MECHANICS FOR MEMS DESIGN **9**

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

UNIT III ELECTRO STATIC DESIGN **9**

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inchworms, Electromagnetic actuators, Bistable actuators

UNIT IV CIRCUIT AND SYSTEM ISSUES **9**

Electronic Interfaces, Feed back systems, Noise, Circuit and system issues, Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Modeling of MEMS systems, CAD for MEMS.

UNIT V INTRODUCTION TO OPTICAL AND RF MEMS **9**

Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF MEMS – design basics, case study – Capacitive RF MEMS switch, performance issues.

TOTAL : 45

TEXT BOOK:

1. Stephen Santeria, “Microsystems Design”, Kluwer publishers, 2000.

REFERENCES :

1. Nadim Maluf, “An introduction to Micro electro mechanical system design”, Artech House,2000.

2. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton,2000.

3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

MEX 010 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS L T P C
3 0 0 3

OBJECTIVE:

- To learn the design of jigs, fixtures and press tools.
- To understand the working of jigs, fixtures and press tools.
- To understand the design and development of 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 2004

2. Donaldson. C, “Tool Design”, Tata McGraw-Hill, 1986

REFERENCES :

1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society”, 1978

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, 2003

4. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983

5. Design Data Handbook PSG College of Technology, Coimbatore

MEX 012 COMPUTATIONAL FLUID DYNAMICS AND HEAT TRANSFER **L T P C 3 0 0 3**

OBJECTIVE:

- To learn basics of CFD and its applications.
- To understand the CFD modeling and simulation techniques.
- To understand the application of CFD in heat transfer problems and CFD flow field problems.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

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

UNIT II DISCRETIZATION AND SOLUTION METHODOLOGIES 9

Methods of Deriving the Discretization Equations - Taylor Series formulation – Finite difference method – Control volume Formulation – Spectral method. 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 - Discretization 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-ε) models.

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 2004 Indian Edition.

2. Muralidhar, K and Sundarajan .T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 1995.

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, 1996.

5. Anderson, J.D., “Computational fluid dynamics – the basics with applications”, 1995.

MEX 022 NANOTECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To enable the students to learn about nanotechnology.
- To learn fundamental of nanotechnology and its applications.
- To learn Nano material fabrication and machining.

UNIT I INTRODUCTION TO NANOMATERIALS 7

Amorphous, Crystalline, microcrystalline, quasicrystalline and nanocrystalline materials- historical Development of nano materials-problems in fabrication and characterization of nano materials.

UNIT II PRODUCTION OF NANOMATERIALS 10

Methods of production of nanomaterials, Sol-gel synthesis, Inert gas condensation, Mechanical alloying or high-energy ball milling, Plasma synthesis, and Electrodeposition.

UNIT III APPLICATION OF NANO MATERIALS 10

Applications in Electronics, Chemical, Mechanical engineering industries-Use of nanomaterials in automobiles, aerospace, defence and medical applications – Metallic, polymeric, organic and ceramic nanomaterials.

UNIT IV NANOFABRICATION AND MACHINING 8

LIGA, Ion Beam Etching, Molecular Manufacturing Techniques - Nano Machining Techniques, Top down and Bottom up Nano fabrication Techniques, Quantum Materials.

UNIT V INSPECTION OF NANOMATERIALS 10

Scanning Probe Microscopy (SPM)- Contact Mode, Tapping Mode, Scanning Tunnelling Mode (STM). Advanced Scanning Probe Microscopy – Electrostatic force Mode (EFM)- Magnetic Force Mode (MFM)- Scanning Thermal Mode (SthM), Piezo Force Mode (PFM). Scanning Capacitance Mode (SCM), Nanoidentation.

TOTAL : 45

REFERENCE:

1. Mark Ratner and Daniel Ratner, “Nano Technology”, Pearson Education, New Delhi, 2003.

MEX 027 PROFESSIONAL ETHICS IN ENGINEERING **L T P C**

3 0 0 3

AIM:

To sensitize the engineering students on blending both technical and ethical responsibilities.

OBJECTIVES:

- Identify the core values that shape the ethical behavior of an engineer.
- Utilize opportunities to explore one's own values in ethical issues.
- Become aware of ethical concerns and conflicts.
- Enhance familiarity with codes of conduct.
- Increase the ability to recognize and resolve ethical dilemmas.

UNIT I ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as Responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY **9**

Safety and Risk – Assessment of Safety and Risk – Risk Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS **9**

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 **9**

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics -Role in Technological Development – Weapons

Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL: 45

TEXT BOOKS :

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, NewYork (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering EthicsConcepts and Cases”, Thompson Learning, (2000).

REFERENCES :

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, (1999).
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientistsand Engineers”, Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

MEX 028 OPTIMAZATION TECHNIQUES IN ENGINEERING **L T P C**
3 0 0 3

OBJECTIVE:

- To learn the various optimization techniques and its applications.
- To have good exposure to optimization techniques like linear programming, non linear programming and dynamic programming

UNIT I INTRODUCTION **5**

Statement of optimization problems – classification of optimization problem – classical optimization techniques; Single variable optimizations, Multi variable optimization, equality constraints, Inequality constraints, No constraints.

UNIT II LINEAR PROGRAMMING **10**

Graphical method for two dimensional problems – central problems of Linear Programming – Definitions – Simplex – Algorithm – Phase I and Phase II of Simplex Method – Revised Simplex Method.

Simplex Multipliers – Dual and Primal – Dual Simplex Method – Sensitivity Analysis – Transportation problem and its solution – Assignment problem and its solution by Hungarian method – Karmakar's method – statement, Conversion of the Linear Programming problem into the required form, Algorithm.

UNIT III NON LINEAR PROGRAMMING **15**

Introduction – Unrestricted search – Exhaustive search – Interval halving method – Fibonacci method.

Unconstrained Optimization: – Introduction – Random search method – Uni variate method – Pattern search methods – Hooke and Jeeves method, Simplex method– Gradient of a function – steepest descent method – Conjugate gradient method.

Constrained Optimization: Introduction – Characteristics of the problem – Random search methods – Complex method.

UNIT IV DYNAMIC PROGRAMMING **7**

Introduction – multistage decision processes – Principles of optimality – Computation procedures.

UNIT V DECISION MAKING: 7

Decisions under uncertainty, under certainty and under risk – Decision trees – Expected value of perfect information and imperfect information.

TOTAL : 44

REFERENCES:

1. Kalyanmoy Deb, “Optimization for Engineering Design, Algorithms and Examples”, Prentice Hall, 2004.
2. Hamdy A Taha , “Operations Research – An introduction”, Pearson Education , 2002.
3. Hillier / Lieberman, “Introduction to Operations Research”, Tata McGraw Hill Publishing Company Ltd, 2002.
4. Singiresu S Rao, “Engineering Optimization Theory and Practice”, New Age International, 1996.
5. Mik Misniewski, “Quantitative Methods for Decision makers”, MacMillian Press Ltd., 1994.
6. Kambo N S, “Mathematical Programming Techniques”, Affiliated East – West Press, 1991.

MEX 029 ADVANCED PRODUCTION PROCESSES IN AUTOMOTIVE ENGINEERING

L	T	P	C
3	0	0	3

AIM:

To learn the advanced production process employed for manufacturing of automotive components.

OBJECTIVE:

- To learn the advanced manufacturing process like powder metallurgy, gear manufacturing and CNC operations, employed on the production of automative components.

UNIT I POWDER METALLURGY **8**

Process flow chart – Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – Testing and inspection of PM parts.

UNIT II FORMING PROCESS **15**

Forging – process flow chart, forging of valves – connecting rod, crank shaft, cam shaft,propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydroforming: Process, hydroforming of manifold and comparison with conventional methods – Hydro forming of tail lamp housing. Stretch forming – Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

UNIT III GEAR MANUFACTURING **8**

Different methods of Gear manufacture – Gear hobbing and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNIT IV CONCEPT & PROGRAMMING OF CNC MACHINES **8**

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feed back devices – manual part programming – steps involved – sample program in Lathe & milling.

UNIT V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS 6

Powder injection moulding – Shotpeen hardening of gears – Production of aluminium MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminium composite brake rotors.

TOTAL :45

TEXT BOOK

1. Heldt, P.M., High Speed Combustion Engines, Oxford Publishing Co., New York, 1990.

REFERENCES

1. Haslehurst,S.E., Manufacturing Technology, ELBS, London, 1990.
2. Rusinoff, Forging and Forming of metals, D.B. Taraporevala Son & Co. Pvt.Ltd., Mumbai, 1995.
3. Subroff,A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, New York, 1988.
4. High Velocity Forming of Metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.
5. Groover.M.P., Automatic production systems and computer integrated manufacturing, Prentice-Hall, 1990.
6. GE Thyer, Computer Numerical Control of Machine Tools, BH.Newners, 1991.