



# **HINDUSTAN UNIVERSITY**

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

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

Padur, Kancheepuram District - 603 103.

## **DEPARTMENT OF AUTOMOBILE ENGINEERING**

### **Syllabus with Curriculum and Regulations 2013**

## **B.Tech. AUTOMOBILE ENGINEERING**



**ACADEMIC REGULATIONS (B.Tech)**  
**(Full /Part Time) (Effective 2013-14)**

**1. Vision, Mission and Objectives**

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

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

**1.2 Further, the Institute always strives**

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

**1.3** Aims and Objectives of the Institute are focused on

- Providing world class education in engineering, technology, applied sciences and management.

- Keeping pace with the ever changing technological scenario to help the students to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and nation.
- To inculcate a flair for research, development and entrepreneurship.

**2. Admission**

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

**2.2 (i) Full-Time :**

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

**(ii) Part -Time:**

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

and a minimum of one year practical experience.

- 2.3** The selected candidates will be admitted to the B.Tech. programme after he/she fulfills all the admission requirements set by the Institute and after the payment of the prescribed fees.
- 2.4** In all matters relating to admission to the B.E. / B.Tech. programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.
- 2.5** If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.

### **3. Structure of the programme**

- 3.1** The programme of instruction will have the following structure:
- i) A general (common) core programme comprising basic sciences, engineering sciences, humanities, technical arts and mathematics.
  - ii) An engineering core programme introducing the student to the foundations of engineering in the respective branch.
  - iii) An elective programme enabling the student to opt and undergo a set of courses of interest to him/ her.
  - iv) Professional practice including project, seminar and industrial training.
  - v) General elective courses, such as, Environmental Studies, Physical Education, Professional ethics, and National Service Scheme.

The distribution of total credits required for the degree programme into the above

five categories will nominally be 20%, 50%, 15%, 5%, and 10% respectively.

#### **3.2 (i) Full-Time:**

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

#### **ii) Part - Time:**

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

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

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

#### **3.4 (i) Full-Time:**

For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits of 190-200.

(ii) **Part-Time:**

For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits of 110-120.

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

4. **Faculty Advisor**

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

5. **Class Committee**

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

- (i) A Chairman, who is not teaching the class.
- (ii) All subject teachers of the class.
- (iii) Two students nominated by the department in consultation with the class.

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

**The functions of the Class Committee will include:**

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

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

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

6. **Grading**

6.1 A grading system as below will be adhered to.

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

6.2 **GPA and CGPA**

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

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

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

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

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

## **7. Registration and Enrolment**

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

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

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

## **8. Registration requirement**

### **8.1 (i) Full -Time:**

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

### **(ii) Part -Time:**

A part time student shall not register for less than 10 credits or more than 20 credits in any given semester

**8.2** If a student finds his/her load heavy in any semester, or for any other valid reason, he/she may withdraw from the

courses within three weeks of the commencement of the semester with the written approval of his/her Faculty Advisor and HOD. However the student should ensure that the total number of credits registered for in any semester should enable him/her to earn the minimum number of credits per semester for the completed semesters.

## **9. Continuation of the programme**

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

## **10. Maximum duration of the programme**

### **10.1 (i) Full - Time**

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

### **(ii) Part - Time**

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

## **11. Temporary discontinuation**

**11.1** A student may be permitted by the Director (Academic) to discontinue temporarily from the programme for a semester or a longer period for reasons of ill health or other valid reasons.

Normally a student will be permitted to discontinue from the programme only for a maximum duration of two semesters.

## **12. Discipline**

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

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

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

## **13. Attendance**

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

**13.2** Those who have less than 75% attendance will be considered for condonation of shortage of attendance. However, a condonation of 10% in attendance will be given on medical

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

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

## **14. Assessment Procedure**

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

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

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

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

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

- (i) Weekly assignment/Observation note book / lab records - weightage 60%.
- (ii) End semester examination of 3 hours duration including viva - weightage 40%.

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

**15. Make up Examination/Model Exam**

**15.1** Students who miss the end-semester examinations / model examination for valid reasons are eligible for make-up examination /model examination. Those who miss the end-semester examination / model examination should apply to the Head of the Department concerned within five days after he / she missed examination, giving reasons for absence.

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

endorsed by parent / guardian and also by a medical officer of the University within 5 days.

**16. Project evaluation**

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

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

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

**17. Declaration of results**

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

- (ii) To be Eligible to appear for the end semester examinations for a particular course, a candidate will have to secure a minimum of 40% marks in the sessional for that course.
- (iii) Candidates are required to obtain all credits assigned to the first two semesters of the programme within the



first four semesters of the programme. Candidates failing to satisfy this requirement will not be allowed to proceed to the fifth semester until the condition is satisfied. Further, candidates will not be allowed to proceed to seventh semester if they have not cleared all the courses assigned during third & fourth semesters.

- 17.2** After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of UG programmes constituted by the Vice-Chancellor. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee of the Academic Council constituted by the Chancellor for scrutiny. The minutes of the Standing Sub Committee along with the results are to be placed before the Vice-Chancellor for approval. After getting the approval of the Vice-Chancellor, the results will be published by the Controller of Examination/ Registrar.
- 17.3** If a candidate fails to secure a pass in a course due to not satisfying the minimum requirement in the end-semester examination, he/she shall register and re-appear for the end-semester examination during the following semester. However, the sessional marks secured by the candidate will be retained for all such attempts.
- 17.4** If a candidate fails to secure a pass in a course due to insufficient sessional marks though meeting the minimum requirements of the end-semester examination, and wishes to improve on his/her sessional marks, he/she will have to register for the particular course and

attend the course with permission of the HOD concerned and Director(Academic) with a copy marked to the Registrar. The sessional and external marks obtained by the candidate in this case will replace the earlier result.

- 17.5** A candidate can apply for the revaluation of his/her end-semester examination answer paper in a theory course within 2 weeks from the declaration of the results, on payment of a prescribed fee through proper application to the Registrar/ Controller of Examinations through the Head of the Department. The Registrar/ Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.
- 17.6** After ten semesters, the sessional marks of the candidate will not be considered for a pass in a course. A candidate who secures 50% in the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

## **18. Grade Card**

- 18.1** After results are declared, grade sheet will be issued to each student which will contain the following details:
- (i) Program and branch for which the student has enrolled.
  - (ii) Semester of registration.
  - (iii) List of courses registered during the semester and the grade scored.
  - (iv) Semester Grade Point Average (GPA)
  - (v) Cumulative Grade Point Average (CGPA).

## 19. Class/Division

### 19.1 Classification is based on CGPA and is as follows:

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

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

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

- 19.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance within the minimum duration of the programme.
- (ii) The award of 'First Class' is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses **within 10 semesters.**
- (iii) The period of authorized discontinuation of the programme (vide clause 11.1) will not be counted for the purpose of the above classification.

## 20. Transfer of credits

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

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

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

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

- i) registered and successfully acquired the credits for the core courses;
- ii) successfully acquired the credits in the different categories as specified in the curriculum corresponding to the discipline (branch) of his/her study within the stipulated time;
- iii) has no dues to all sections of the Institute including Hostels, and
- iv) has no disciplinary action pending against him/her.

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

## 22. Change of Branch

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

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

## 23. Power to modify

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

**HINDUSTAN UNIVERSITY**  
**HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE**  
**SCHOOL OF AERONAUTICAL ENGINEERING**

**SEMESTER - I**

(Common to all branches)

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	EL 2101	Technical English	3	0	0	3	3
2.	MA 2101	Engineering Mathematics-I	3	1	0	4	4
3.	PH 2001 CY 2001	Engineering Physics / Engineering Chemistry *	3	0	0	3	3
4.	ME 2101	Engineering Graphics	1	0	3	3	4
5.	CS 2101	Computer Programming	3	0	0	3	3
<b>PRACTICAL</b>							
1.	CS2131	Computer Programming Laboratory	0	0	3	2	3
2.	GE 2131	Engineering Practices Laboratory-I	0	0	3	2	3
3.	EL 2131	Communication Skills Laboratory I	0	0	3	2	3
4.	PH 2031 CY 2031	Physics Laboratory/ Chemistry Laboratory *	1	0	3	3	4
		<b>Total</b>				<b>25</b>	<b>30</b>

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

**SEMESTER – II**

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	MA2201	Engineering mathematics-II#	3	1	0	4	4
2.	CY2001/ PH 2001	Engineering Chemistry / Engineering Physics *#	3	0	0	3	3
3.	EE2213	Basic Electrical Technology	3	0	0	3	3
4.	ME2201	Engineering Mechanics**	3	1	0	4	4
5.	AT2201	Production Technology - I	3	0	0	3	3
<b>Practical</b>							
6.	CY2031 PH2031	Chemistry Laboratory / Physics Laboratory *#	1	0	3	3	4
7.	GE2231	Engineering Practices Laboratory -II#	0	0	3	2	3
8.	EL 2231	Communication Skills Laboratory-II#	2	0	2	3	4
9.	EE2236	Basic Electrical Laboratory	0	0	3	2	3
		<b>Total</b>				<b>27</b>	<b>31</b>

\* Depending upon the number of batches, it will be alternated between semester I&II

\*\* Common to Automobile and Mechanical Engineering

#Common to all branches

**SEMESTER – III**

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	MA2301	Engineering Mathematics III *	3	1	0	4	4
2.	AT2301	Kinematics of Machines	3	1	0	4	4
3.	AT2302	Applied Thermodynamics	3	1	0	4	4
4.	AT2303	Production Technology II	3	0	0	3	3
5.	AT2304	Automotive Engines	3	0	0	3	3

<b>PRACTICAL</b>							
6.	AT2331	Computer Aided Machine Drafting Laboratory	0	0	3	2	3
7.	AT2332	Automotive Engine Components Laboratory	0	0	3	2	3
8.	AT2333	Engine Testing Laboratory	0	0	3	2	3
9.	AT2334	Production Technology Laboratory	0	0	3	2	3
		<b>Total</b>				<b>26</b>	<b>30</b>

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

#### SEMESTER - IV

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	ME2402	Strength of Materials **	3	1	0	4	4
2.	AT2401	Dynamics of Machines	3	1	0	4	4
3.	AT2402	Fluid Mechanics and Machinery	3	1	0	4	4
4.	AT2403	Automotive Chassis	3	0	0	3	3
5.	AT2404	Automotive Transmission	3	0	0	3	3
<b>PRACTICAL</b>							
6.	AT2431	Fluid Mechanics and Machinery Laboratory	0	0	3	2	3
7.	AT2432	Automotive Chassis Components Laboratory	0	0	3	2	3
8.	ME2432	Strength of Materials Laboratory **	0	0	3	2	3
9.	AT2433	Project Work	0	0	6	2	6
		<b>Total</b>				<b>26</b>	<b>33</b>

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

### SEMESTER - V

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	AT2501	Heat & Mass Transfer	3	1	0	4	4
2.	AT2502	Automotive Materials and Metallurgy	3	0	0	3	3
3.	AT2503	Automotive Electrical and Electronics	3	0	0	3	3
4.	AT2504	Two and Three Wheelers	3	0	0	3	3
5.	AT2505	Automotive Engine Components Design	3	1	0	4	4
6.	AT2506	Special Types of Vehicles	3	0	0	3	3
<b>PRACTICAL</b>							
7.	AT2531	Automotive Electrical and Electronics Laboratory	0	0	3	2	3
8.	AT2532	Two and Three Wheelers Laboratory	0	0	3	2	3
9.	AT2533	Internship / Industrial Training	0	0	3	2	3
10.	EL2431	Communication Skills and Personality Development #	2	0	2	3	4
		<b>Total</b>				<b>29</b>	<b>33</b>

# Common to all branches

### SEMESTER - VI

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	MG2001	Principles of Management*	3	0	0	3	3
2.	CY2002	Environmental Science and Engineering**	3	0	0	3	3
3.	AT2601	Automotive Pollution and Control	3	0	0	3	3
4.	AT2602	Vehicle Dynamics	3	1	0	4	4
5.	AT2603	Automotive Chassis Design	3	1	0	4	4
6.	AT2604	Automotive Safety	3	0	0	3	3

<b>PRACTICAL</b>							
7.	AT2631	Computer Aided Engine and Chassis Design Laboratory	0	0	3	2	3
8.	AT2632	Vehicle Dynamics Laboratory	0	0	3	2	3
9.	AT2633	Fuels & Lubricants Laboratory	0	0	3	2	3
		<b>Total</b>				<b>26</b>	<b>29</b>

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

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

### SEMESTER - VII

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	MG2002	Total Quality Management*	3	0	0	3	3
2.	AT2701	Vehicle Body Engineering	3	0	0	3	3
3.	AT2702	Vehicle Maintenance	3	0	0	3	3
4.	AT2703	Automotive Instrumentation & Embedded System	3	0	0	3	3
5.	AT2704	Manufacturing Process of Automotive Components	3	0	0	3	3
6.		Elective-I	3	0	0	3	3
<b>PRACTICAL</b>							
7.	AT2731	Software Applications Laboratory	0	0	3	2	3
8.	AT2732	Vehicle Maintenance and Reconditioning Laboratory	0	0	3	2	3
		<b>Total</b>				<b>22</b>	<b>24</b>

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

**SEMESTER-VIII**

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	AT2801	Modern Vehicle Technology	3	0	0	3	3
2.		Elective-II	3	0	0	3	3
3.		Elective-III	3	0	0	3	3
<b>Practical</b>							
	AT2831	Project & Viva-voce			24	6	24
		<b>Total</b>				<b>15</b>	<b>33</b>

**TOTAL CREDITS = 196**

**LIST OF ELECTIVES FOR VII SEMESTER**

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	ME2755	Quality Control and Reliability Engineering**	3	0	0	3	3
2.	ME2757	Computational Fluid Dynamics**	3	0	0	3	3
3.	AT2751	Composite Materials and Structures	3	0	0	3	3
4.	AT2752	Finite Element Methods in Automobiles	3	0	0	3	3
5.	AT2753	Automotive Aerodynamics	3	0	0	3	3

\*\*Common to Automobile and Mechanical Engineering

**LIST OF ELECTIVES FOR VIII SEMESTER**

Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
1.	AT2851	Simulation of IC engines	3	0	0	3	3
2.	AT2852	Advanced theory of IC engines	3	0	0	3	3
3.	AT2853	Electronic Engine Management System	3	0	0	3	3
4.	AT2854	Vibration and Noise Control	3	0	0	3	3
5.	AT2855	Automotive Air Conditioning	3	0	0	3	3



Sl. No.	Course Code	Course Title	L	T	P	C	TCH
<b>THEORY</b>							
6.	AT2856	Automotive Sensors and Applications	3	0	0	3	3
7.	AT2857	Fuel Cells and Applications	3	0	0	3	3
8.	AT2858	Robotics	3	0	0	3	3
9.	AT2859	Alternative Fuels and Energy System	3	0	0	3	3
10.	MG2005	Engineering Economics and Cost Analysis**	3	0	0	3	3

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

**SEMESTER - I**  
**EL 2101 TECHNICAL ENGLISH**

**L T P C**  
**3 0 0 3**

**GOAL**

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

**OBJECTIVES**

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

**OUTCOME**

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

**UNIT I LISTENING SKILL**

**9**

Listening to short and extended dialogues, telephone conversations, discussions, soliloquies - Listening to prose & poetry reading -- Listening to sounds, silent letters, stressed syllables in English -- Listening to video clips, documentaries, feature films, presentations, interviews -- Listening for the gist of the text, for identifying a topic, general meaning and specific information -- Listening for multiple-choice questions, for positive & negative comments, for interpretation -- Listening for advanced interpretation.

**UNIT II SPEAKING SKILL****9**

Introducing oneself or expressing personal opinion -- Simple oral or casual interaction - Dialogue -- Conversation - Giving and receiving feedback using Johari window - Debates -- Brief presentations -- Differences between disagreeing and being disagreeable -- Participating in group discussions, role plays and interviews -- Generating talks based on visual or written prompts -- Addressing a small group or a large formal gathering - Comparing, contrasting, justifying, agreeing and disagreeing on advanced topics - Speaking about present and past experiences and future plans - Debates, discussions and role plays on advanced topics - Job interviews - Preparing HR questions with possible answers -- Brief presentations - Arguing out a topic without verbal fights -- Power point presentation.

**UNIT III READING SKILL****9**

Reading for skimming and scanning -- Reading for the gist of a text, for specific information, for information transfer and interpretation -- Reading and interpreting anecdotes, short stories, poems, prose passages for intellectual and emotional comments - Reading a Fishbone diagram for strengths and weaknesses, for pros and cons - Reading comprehension exercises for multiple-choice questions, for contextual meaning -- Reading newspapers, magazine articles for critical comments.

**UNIT IV WRITING SKILL****9**

Writing emails, messages, notices, agendas, leaflets, brochures, instructions, recommendations, functional checklists, minutes of a meeting -- Writing paragraphs, comparing, contrasting, presentations with an Introduction, Body and Conclusion -- Arranging appointments, asking for permission, apologizing and offering compensation - Writing formal business letters -- Letter inviting, accepting, declining the invitation -- Letter to the editor -- Requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letter applying for a job, enclosing a CV or Resume - - Writing short reports -- Industrial accident reports -- Writing short proposals.

**UNIT V THINKING SKILL****9**

Developing the acquisition and imparting the knowledge of English using thinking skills -- Eliciting thinking blocks for critical interpretation -- Decoding diagrammatic and pictorial representations into English orthographic version in the form of words, phrases, expressions, idioms, sayings and proverbs.

**TOTAL : 45****REFERENCES**

1. Norman Whitby. Business Benchmark: Pre-Intermediate to Intermediate - BEC Preliminary. New Delhi: Cambridge University Press, 2008 (Latest South Asian edition).
2. Devaki Reddy & Shreesh Chaudhary. Technical English. New Delhi: Macmillan, 2009.
3. Rutherford, Andrea J. Basic Communication Skills for Technology. 2nd edition. New Delhi: Pearson Education, 2010.

## MA 2101 ENGINEERING MATHEMATICS - I

L	T	P	C
3	1	0	4

### GOAL

To create the awareness and comprehensive knowledge in engineering mathematics.

### OBJECTIVES

The course should enable the students to:

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

### OUTCOME

The students should be able to:

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

### UNIT I MATRICES

12

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

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

### UNIT II DIFFERENTIAL CALCULUS

12

Review: Basic concepts of differentiation - function of function, product and quotient rules.Methods of differentiation of functions - Cartesian form - Parametric form - Curvature - Radius of curvature -

Centre of curvature - Circle of curvature. Evolutes of parabola, circle, ellipse, hyperbola and cycloid - Envelope.

**UNIT III ORDINARY DIFFERENTIAL EQUATIONS 12**

Review: Definition, formation and solutions of differential equations.

Second order differential equations with constant coefficients - Particular integrals -  $e^{ax}\cos bx, e^{ax}\sin bx$ . Euler's homogeneous linear differential equations - Legendre's linear differential equation - Variation of parameters.

**UNIT IV PARTIAL DIFFERENTIATION 12**

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

**UNIT V TRIGONOMETRY 12**

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

Expansions of  $\sin n\theta, \cos n\theta, \tan n\theta$  where  $n$  is a positive integer. Expansions of  $\sin m\theta \cos n\theta$  in terms of sines and cosines of multiples of  $\theta$  where  $m$  and  $n$  are positive integers. Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers - Separation of complex functions into real and imaginary parts - Simple problems.

**Note: Questions need not be asked from review part.**

**TOTAL : 60**

**TEXT BOOKS**

1. Venkataraman M.K, Engineering Mathematics, Volume I, The National Publishing Company, Chennai, 1985.
2. Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.
3. Chandrasekaran A, A Text book of Engineering Mathematics I, Dhanam Publications, Chennai, 2010.

**REFERENCES**

1. Erwin Kreyzig, A Text book of Engineering Mathematics, John Wiley, 1999.
2. Kandaswamy P, Thilagavathy K and Gunavath K, Engineering Mathematics, Volume I & II, S.Chand and Company, New Delhi, 2005.
3. Bali N.P, Narayanalyengar. N.Ch., Engineering Mathematics, Laxmi Publications Pvt. Ltd, New Delhi, 2003.
4. Veerarajan T, Engineering Mathematics (for first year), Fourth Edition, Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.

## PH 2001 ENGINEERING PHYSICS

L T P C  
3 0 0 3

### GOAL

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

### OBJECTIVES

1. To develop strong fundamentals of properties and behavior of the materials
2. To enhance theoretical and modern technological aspects in acoustics and ultrasonics.
3. To enable the students to correlate the theoretical principles with application oriented study of optics.
4. To provide a strong foundation in the understanding of solids and materials testing.
5. To enrich the knowledge of students in modern engineering materials.

### OUTCOME

The student will

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

### UNIT I PROPERTIES OF MATTER

9

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

### UNIT II ACOUSTICS AND ULTRASONICS

9

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

**UNIT III LASER AND FIBRE OPTICS****9**

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO<sub>2</sub> laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

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

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

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

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

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

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High T<sub>c</sub> superconductors (qualitative) - uses of superconductors.

**TOTAL : 45****TEXT BOOKS**

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

**REFERENCES**

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

## CY 2001 ENGINEERING CHEMISTRY

L T P C  
3 0 0 3

### GOAL

To impart basic principles of chemistry for engineers.

### OBJECTIVES

The objective of the course is

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

### OUTCOME

Upon successful completion of the course, the outcomes are as follows:

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

### UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY

9

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

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



## UNIT II ENGINEERING MATERIALS

9

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications.- Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS<sub>2</sub> And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives - Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

## UNIT III ELECTRO CHEMISTRY AND CORROSION

9

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

## UNIT IV CHEMICAL THERMODYNAMICS

9

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

## UNIT V FUELS AND ENERGY SOURCES

9

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

**TOTAL : 45**

## TEXT BOOKS

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

## REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004
3. A. Gowariker, Text Book of Polymer Science, 2002
4. Kuriacose &Rajaram, Vols. 1 &2, Chemistry in Engineering and Technology, 2004
5. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

## ME 2101 ENGINEERING GRAPHICS

L T P C  
1 0 3 3

### GOAL

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

### OBJECTIVES

The course should enable the students to

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

### OUTCOME

The students should be able to

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

Note: Only first angle projection is to be followed

### BASICS OF ENGINEERING GRAPHICS

2

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

### UNIT I PROJECTION OF POINTS, LINES AND SURFACES

15

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

### UNIT II PROJECTION OF SOLIDS

10

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

**UNIT III DEVELOPMENT OF SURFACES 10**

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

**UNIT IV ORTHOGRAPHIC PROJECTIONS 10**

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

**UNIT V PICTORIAL PROJECTIONS 10**

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

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

Introduction to computer aided drafting and dimensioning using appropriate software.

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

**TOTAL : 60**

**TEXT BOOKS**

1. JeyapoovanT, Engineering Drawing and Graphics Using Auto CAD, Vikas Publishing House Pvt Ltd., New Delhi, 2010.
2. WarrenJ.Luzadder and Jon.M.Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2003.

**REFERENCES**

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

## CS 2101 COMPUTER PROGRAMMING

L T P C  
3 0 0 3

### GOAL

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

### OBJECTIVES

The course should enable the students to:

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

### OUTCOME

The student should be able to:

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

### UNIT I COMPUTER FUNDAMENTALS

9

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

### UNIT II COMPUTER PROGRAMMING AND LANGUAGES

9

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

### UNIT III PROGRAMMING WITH C

9

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

### UNIT IV FUNCTIONS, ARRAYS AND STRINGS

9

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

### UNIT V POINTERS, STRUCTURES AND UNION

9

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

**TOTAL: 45**

### TEXT BOOK

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

## REFERENCES

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

## CS 2131 COMPUTER PROGRAMMING LABORATORY

L T P C  
0 0 3 2

## GOAL

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

## OBJECTIVES

The course should enable the students to:

- (i) To gain knowledge about Microsoft office, Spread Sheet.
- (ii) To learn a programming concept in C..

## Outcome

The student should be able to:

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

## LIST OF EXPERIMENTS

### a) Word Processing 12

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

### b) Spread Sheet 9

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document

**c) Programming in C**

**24**

- 8. To write a C program to prepare the electricity bill.
- 9. Functions:
  - (a) Call by value      (b) Call by reference.
- 10. To write a C program to print the Fibonacci series for the given number.
- 11. To write a C program to find the factorial of number using recursion.
- 12. To write a C program to implement the basic arithmetic operations using Switch Case statement.
- 13. To write a C program to check whether the given number is an Armstrong number.
- 14. To write a C program to check whether the given string is a Palindrome.
- 15. To write a C program to create students details using Structures.
- 16. To write a C program to demonstrate the Command Line Arguments.
- 17. To write a C program to implement the Random Access in Files.
- 18. To write C programs to solve some of the Engineering applications

**TOTAL 45**

**HARDWARE/SOFTWARE REQUIRED FOR BATCH OF 30 STUDENTS**

**HARDWARE**

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

Printers - 3 Nos

**SOFTWARE**

OS - Windows / UNIX

Application package - MS office

Software - C language

**GE 2131 ENGINEERING PRACTICES LABORATORY - I**

**L T P C**  
**0 0 3 2**

**GOAL**

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

**OBJECTIVES**

The course should enable the students to

- 1. Relate theory and practice of basic Civil and Mechanical Engineering

2. Learn concepts of welding and machining practice
3. Learn concepts of plumbing and carpentry practice

### OUTCOME

The students should be able to

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

### LIST OF EXPERIMENTS

#### I. MECHANICAL ENGINEERING PRACTICE

24

##### 1. Welding

Arc welding: Butt joints, Tee and lap joints.

##### 2. Basic Machining

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

##### 3. Machine assembly practice

Study of centrifugal pump

##### 4. Study on

a. Smithy operations - Production of hexagonal headed bolt.

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

#### II. CIVIL ENGINEERING

21

1. Basic pipe connection using valves, couplings, unions, reducers, elbows in household fitting.
2. Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.
3. Wood work: Sawing, Planning and making common joints.
4. Study of joints in door panels, wooden furniture.

**TOTAL : 45**

### List of Equipments

(For a Batch of 30 Students)

#### CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.

2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools:
  - (a) Rotary Hammer 2 Nos
  - (b) Demolition Hammer 2 Nos
  - (c) Circular Saw 2 Nos
  - (d) Planer 2 Nos
  - (e) Hand Drilling Machine 2 Nos
  - (f) Jigsaw 2 Nos

#### **MECHANICAL**

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

#### **EL 2131 COMMUNICATION SKILLS LABORATORY-I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

#### **GOAL**

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

#### **OBJECTIVES**

The course should enable the students to

1. Extend the ability of the learners to be able to listen to English and comprehend its message.
2. Enable the learners to have a functional knowledge of spoken English.
3. Assist the learners to read and grasp the meaning of technical and non-technical passages in English.



4. Help the learners develop the art of writing without mistakes.
5. Expand the thinking capability of the learners so that they would learn how to view things from a different angle.

### **OUTCOME**

The students should be able to

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

### **UNIT I LISTENING SKILL**

**9**

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

### **UNIT II SPEAKING SKILL**

**9**

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

### **UNIT III READING SKILL**

**9**

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

### **UNIT IV WRITING SKILL**

**9**

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

### **UNIT V THINKING SKILL**

**9**

Topics: Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms and proverbs - Inculcating interest in English using thinking blocks.

Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading

**TOTAL : 45**

**REFERENCE BOOK**

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

**WEBSITES FOR LEARNING ENGLISH**

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

**EQUIPMENTS REQUIRED**

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

**PH 2031 PHYSICS LABORATORY**

**L T P C**  
**1 0 3 3**

**OBJECTIVE**

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

**OUTCOME**

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

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

**LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS**

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

**REFERENCES**

1. P.Mani, Engineering Physics Practicals, Dhanam Publications, 2011.

**CY 2031 CHEMISTRY LABORATORY**

**L T P C**  
**1 0 3 3**

**OBJECTIVE**

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

**OUTCOME**

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

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

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

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

**REFERENCES**

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

**SEMESTER-II**  
**MA 2201 ENGINEERING MATHEMATICS - II**

**L T P C**  
**3 1 0 4**

**GOAL**

To create the awareness and comprehensive knowledge in engineering mathematics.

**OBJECTIVES**

The course should enable the students to:

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

**OUTCOME**

The students should be able to:

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

**UNIT I MULTIPLE INTEGRALS**

**12**

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

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

**UNIT II VECTOR CALCULUS**

**12**

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

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

**UNIT III ANALYTIC FUNCTIONS****12**

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

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

**UNIT IV COMPLEX INTEGRATION****12**

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

**UNIT V LAPLACE TRANSFORM****12**

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

**TOTAL: 60**

Note: Questions need not be asked from review part.

**TEXT BOOKS**

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

**REFERENCE**

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



## CY 2001 ENGINEERING CHEMISTRY

L T P C  
3 0 0 3

### GOAL

To impart basic principles of chemistry for engineers.

### OBJECTIVES

The objective of the course is :

1. To make the students conversant with the basics of Water technology and Polymer science.
2. To provide knowledge on the requirements and properties of a few important engineering materials.
3. To educate the students on the fundamentals of corrosion and its control.
4. To give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
5. To create an awareness among the present generation about the various conventional energy sources.

### OUTCOME

Upon successful completion of the course, the outcomes are as follows:

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

### UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY

9

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

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

**UNIT II ENGINEERING MATERIALS****9**

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications.- Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS<sub>2</sub> And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives - Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

**UNIT III ELECTRO CHEMISTRY AND CORROSION****9**

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

**UNIT IV CHEMICAL THERMODYNAMICS****9**

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

**UNIT V FUELS AND ENERGY SOURCES****9**

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

**TOTAL : 45****TEXT BOOKS**

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

**REFERENCES**

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003

2. A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004
- A. Gowarikar, Text Book of Polymer Science, 2002
3. Kuriacose & Rajaram, Vols. 1 &2, Chemistry in Engineering and Technology, 2004
4. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

### PH 2001 ENGINEERING PHYSICS

**L T P C**  
**3 0 0 3**

#### GOAL

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

#### OBJECTIVES

1. To develop strong fundamentals of properties and behavior of the materials
2. To enhance theoretical and modern technological aspects in acoustics and ultrasonics.
3. To enable the students to correlate the theoretical principles with application oriented study of optics.
4. To provide a strong foundation in the understanding of solids and materials testing.
5. To enrich the knowledge of students in modern engineering materials.

#### OUTCOME

The student will

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

#### UNIT I PROPERTIES OF MATTER

**9**

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

#### UNIT II ACOUSTICS AND ULTRASONICS

**9**

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation

time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriction and Piezoelectric methods - properties - applications of ultrasonics with particular reference to detection of flaws in metal ( Non - Destructive testing NDT) - SONAR.

### **UNIT III LASER AND FIBRE OPTICS**

**9**

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO<sub>2</sub> laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

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

**9**

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

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

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

**9**

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

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High T<sub>c</sub> superconductors (qualitative) - uses of superconductors.

**TOTAL : 45**

### **TEXT BOOKS**

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

### **REFERENCES**

1. Uma Mukherji, "Engineering Physics ", Narosa publishing house, New Delhi, 2003.
2. Arumugam M., "Engineering Physics ", Anuradha agencies, 2007.
3. Palanisamy P.K., "Engineering Physics ", SciTech Publications, Chennai 2007.

4. Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw -Hill Publications, 2007.
5. P.Charles, Poole and Frank J. Owens, "Introduction to Nanotechnology", Wiley

### EE 2213 BASIC ELECTRICAL TECHNOLOGY

**L T P C**  
**3 0 0 3**

#### GOAL

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

#### OBJECTIVES

The course should enable the student to:

1. Understand the fundamental of electrical circuits.
2. Understand the principles of operation of D.C. & A.C. machines, generators, motors - starter motors for automotive applications.
3. Know about the various measurements and measuring instruments.

#### OUTCOME

The students should be able to:

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

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

**10**

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

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

**10**

Constructional details and operating principles of D.C motors - back e.m.f. - types of motors - speed and torque equation - load characteristics of D.C motors - starting methods.

Construction and operation of synchronous generators - types of synchronous machines - e.m.f equation - load characteristics - principle of operation of synchronous motors - simple problems.

#### UNIT III TRANSFORMERS

**8**

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

in single phase transformers - introduction to three phase transformers - types of three phase connections.

#### **UNIT IV INDUCTION MACHINES**

**10**

Constructional details and principle of operation of three phase induction motor - types of three phase induction motors - e.m.f equation - rotor e.m.f and current at standstill and running conditions - slip - torque characteristics - losses and efficiency - simple problems.

Construction and principle of operation of single-phase induction motors - starting methods - split phase and shaded pole types.

#### **UNIT V MEASUREMENTS AND MEASURING INSTRUMENTS**

**7**

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

**TOTAL : 45**

#### **TEXT BOOKS**

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

#### **REFERENCES**

1. Stephen J.Chapman, 'Electric Machinery Fundamentals', Third Edition, 1999, McGraw-Hill.
2. K.Murugesh Kumar, 'Basic Electrical Science & Technology', First Published 2002, Vikas Publishing House Private Limited.
3. T.Thyagarajan, K.P.Sendur Chelvi and T.R.Rangaswamy, 'Engineering Basics', Third Edition, 2002, New Age International (P) Limited, Publishers.

### **ME 2201 ENGINEERING MECHANICS**

**L T P C**  
**3 1 0 4**

#### **GOAL**

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

#### **OBJECTIVES**

The course should enable the students to

1. Impart knowledge on the vector and scalar representation of forces and moments

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

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

### **OUTCOME**

The students should be able to

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

### **UNIT I BASICS & STATICS OF PARTICLES 12**

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

### **UNIT II EQUILIBRIUM OF RIGID BODIES 12**

Free body diagram - Types of supports and their reactions - Requirements of stable equilibrium - Static determinacy - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions - Examples.

### **UNIT III FRICTION 12**

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

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

Determination of Areas and Volumes - Determination of first moment of area Centroid of sections,

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

**UNIT V DYNAMICS OF PARTICLES**

**12**

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

**TOTAL : 60**

**TEXT BOOKS**

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

**REFERENCES**

1. Hibbeler, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
2. Ashok Gupta, Interactive Engineering Mechanics - Statics - A Virtual Tutor (CDROM), Pear on Education Asia Pvt., Ltd., 2002.
3. Palanichamy, M.S., Nagan, S., Engineering Mechanics - Statics & Dynamics, Tata McGraw-Hill, 2001.
4. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson Education Asia Pvt., Ltd., 2003.

**AT 2201 PRODUCTION TECHNOLOGY-I**

**L T P C**  
**3 0 0 3**

**GOAL**

The automobile components such as piston, connecting rod, crankshaft, engine block, frontaxle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc. Hence B.E. Automobile Engineering students must study this course Production Technology.



## OBJECTIVES

The course should enable the student to:

- 1 Understand how the automobile parts are manufactured.
- 2 Understand how the different machines are used for machining the components.
- 3 Understand how the components are joined together by using a joining method, which is called as welding, brazing and soldering.
- 4 Understand how the piston is manufactured by casting method.
- 5 Understand, how the cam shaft, crank shaft, connecting rod are manufactured by forging method.

## OUTCOME

The students should be able to:

1. Describe the 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, the different between conventional and un-conventional, the machining of components like gears, shaft, keways, screw and nut.
2. Describe the general principles (with schematic diagrams only) 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.
3. Describe the general principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining, the characteristics of the forming and shaping processes in plastic.
4. Describe the difference between thermoplastic and thermosetting.
5. Describe the working principles and typical applications of Injection moulding, Blow moulding, Rotational moulding, Film blowing, Extrusion in thermoplastic. And Compression moulding, Transfer moulding in thermosetting.

## UNIT I METAL JOINING PROCESSES

9

Classification plastic welding, fusion welding, solid phase welding and sub classification. Study of power sources, electrodes, processes and applications: SMAW, SAWM, GTAW, GMAW, PAW, electro gas welding and electric, resistance welding. Gas welding, oxy acetylene cutting, brazing and soldering. Under water welding. Defects and Inspection of welded joints.

## UNIT II CASTING PROCESSES

9

Sand casting, pattern and core making, moulding, moulding sand properties, gating and riser, moulding methods, melting furnaces - cupola, pit furnace and electric furnaces. Special casting processes - shell, investment, die casting - pressure and gravity types. Plastic moulding - injection and blow moulding, defects in casting and moulding - testing and inspection.

**UNIT III FINISH PROCESSES****9**

Surface finishing processes: grinding processes, various types of grinders, work holding devices, grinding wheels and specification, selection of grinding wheels for specific applications - selection of cutting speed and work speed. Fine Finishing Process: Lapping, honing, and super finishing process.

**UNIT IV METAL FORMING PROCESSES****9**

Hot and cold working processes - rolling, forging, drawing and extrusion processes, bending, hot spinning, shearing, tube and wire drawing, cold forming, shot peening. Sheet metal working - blanking, piercing, punching, trimming, Bending - types of dies - progressive, compound and combination dies. High-energy rate forming processes.

**UNIT V MACHINING PROCESSES****9**

Lathe: working principle, classification, specification accessories, lathe and tool holders, different operations on a lathe, methods of taper turning machining time and power required for cutting, turret and capstan lathes. Drilling and boring: machines- classification, specification, cutters speed feed, machining time parts and description of parts parts-boring machines- jig borer -description, types and hole location procedures.

Milling: classification, principle, parts- specification milling cutters indexing, selection of milling m/c fundamentals of inches processes, milling processes and operations.

**TOTAL : 45****TEXT BOOKS**

1. Hajra Choudhary S.K., "Elements of Manufacturing Technology", Vol. II, 11th edition, Media Publishers, Mumbai, 1997.
2. Rao.P.N., "Manufacturing Technology, Metal Cutting and Machine Tools", Tata McGraw-Hill, 2000.

**REFERENCES**

1. Jain K.C. Agarwal, L.N. "Metal Cutting Science and Production Technology", 1st edition, Khanna Publishers, 1986.
2. Chapman W.A.J., "Workshop Technology", Vol. II, Arnold Publishers.
3. H.M.T., "Production Technology", Tata McGraw-Hill, New Delhi, 2000.

**PH 2031 PHYSICS LABORATORY**

**L T P C**  
**1 0 3 3**

**OBJECTIVE**

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

**OUTCOME**

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

S.No.	List of Experiments	Batch 2 (30)			Batch 1 (30)		
		Week	Periods allotted		Week	Periods allotted	
			L	P		L	P
1	Torsional Pendulum - Determination of rigidity modulus of the material of a wire.	1	1	3	2	1	3
2	Non Uniform Bending - Determination of Young's Modulus.	3	1	3	4	1	3
3	Viscosity -Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.	5	1	3	6	1	3
4	Lee's Disc - Determination of thermal conductivity of a bad conductor.	7	1	3	8	1	3
5	Air Wedge - Determination of thickness of a thin wire.	9	1	3	10	1	3
6	Spectrometer - Refractive index of a prism.	11	1	3	12	1	3
7	Semiconductor laser - Determination of wavelength of Laser using Grating.	13	1	3	14	1	3
	<b>TOTAL</b>		<b>7</b>	<b>21</b>		<b>7</b>	<b>21</b>
<b>56 Periods</b>							

**LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS**

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

**REFERENCES**

1. P.Mani, Engineering Physics Practicals, Dhanam Publications, 2011.

**CY 2031 CHEMISTRY LABORATORY**

**L T P C**  
**1 0 3 3**

**OBJECTIVE**

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

**OUTCOME**

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

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

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

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

**References:**

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

## GE 2231 ENGINEERING PRACTICE LABORATORY-II

L T P C  
0 0 3 2

### GOAL

1. To provide knowledge of basic engineering concepts.

### Objectives

The course should enable the students :

- (i) To impart knowledge on basic engineering concepts.

### Outcome

The students should be able to:

- (i) To learn how to use Electrical and Electronics tools.

### Components Required:

Electrical Engineering

Choke- 2 nos

Starter- 2 nos

Tubelight stand- 2 nos

36W tubelight- 2 nos

Fan- 2nos

40W lamp - 5nos

Single way switch- 10 nos

Two way switch-5 nos

Iron box-2nos

Fan with regulator opened- 1no (demo purpose)

Wires

### Electronics Engineering

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

S.No	LIST OF EXPERIMENTS	HOURS
<b>Electrical Engineering:</b>		
1.	Wiring for a tube light.	6
2.	Wiring for a lamp and fan.	6
3.	Staircase wiring	3
4.	Study of (i) Iron box and (ii) Fan with Regulator Electronics Engineering	6
5.	Study of Electronic components and Equipments	3
6.	Characteristics of PN junction diode & measurement of Ripple factor of half wave and full wave rectifier.	9
7.	Applications of OP-AMP - Inverter, Adder and Subtractor.	9
8.	Study and verification of Logic Gates	3
		<b>P = 45 Total = 45</b>

#### TEXT BOOK

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

### EL 2231 COMMUNICATION SKILLS LABORATORY II

L T P C  
2 0 2 3

#### GOAL

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

#### OBJECTIVES

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

#### OUTCOME

1. The learners will be able to listen to and understand English at an advanced level and interpret its meaning.



2. The learners would have developed English at the formal and informal levels and thus gained the confidence to use it without fear.
3. The learners will be able to read and grasp the in-depth meaning of technical and non-technical passages in English.
4. The learners will have developed the art of formal and informal writing.
5. The learners will be able to think independently and creatively and also verbalize their thoughts fearlessly.

**UNIT I LISTENING SKILL**

**12**

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

**UNIT II SPEAKING SKILL**

**12**

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

**UNIT III READING SKILL**

**12**

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

**UNIT IV WRITING SKILL**

**12**

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

**UNIT V THINKING SKILL**

**12**

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

**TOTAL : 60**

**REFERENCES**

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

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

**Websites :**

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

**Equipments required:**

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

**EE 2236 BASIC ELECTRICAL LABORATORY**

**L T P C**  
**0 0 3 2**

**List of Experiments**

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

**List of Equipments(for batch of 30 students)**

1.	DC Shunt motor	- 2 No
2.	DC Series motor	- 1 No
3.	DC shunt motor-DC Shunt Generator set	- 1 No
4.	DC Shunt motor-DC Series Generator set	- 1 No
5.	Single phase transformer	- 2 No
6.	Three phase alternator	- 2 No
7.	Three phase synchronous motor	- 1 No
8.	Three phase Squirrel cage Induction motor	- 1 No
9.	Three phase Slip ring Induction motor	- 1 No
10.	Single phase Induction motor	- 1 No
		<b>TOTAL : 45</b>

## SEMESTER - III

### MA 2301 ENGINEERING MATHEMATICS III

L	T	P	C
3	1	0	4

#### GOAL

To create the awareness and comprehensive knowledge in engineering mathematics.

#### OBJECTIVES

The course should enable the students to:

- 1) Learn techniques of solving the standard types of first and second partial differential equations.
- 2) Grasp the Fourier series expansions for the given periodic function in the specific intervals and their different forms.
- 3) Learn solving one dimensional wave equation, One and two dimensional heat equation using Fourier series.
- 4) Understand the problems using Fourier transform and learns their properties.
- 5) Understand the problems using Z - transform and learns their properties.

#### OUTCOME

The students should be able to:

- 1) Formulate mathematically certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- 2) Use the knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
- 3) Formulate and identify certain boundary and initial value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve the vibration and heat flow problems and then interpret the results.
- 4) Apply Fourier transform pair, their properties, with the possible special cases with attention to their applications
- 5) Apply the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.

#### UNIT I PARTIAL DIFFERENTIAL EQUATIONS

12

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

#### UNIT II FOURIER SERIES

12

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

range cosine series - Complex form of Fourier Series - Parseval's 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** **12**

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

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

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

**TOTAL: 60**

**TEXT BOOKS**

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. Wylie C. Ray and Barrett Louis, C., "Advanced Engineering Mathematics", Sixth Edition, McGraw-Hill, Inc., New York, 1995.
4. Chandrasekaran A, A Text book of Engineering Mathematics III, Dhanam Publications, Chennai, 2010.

**REFERENCES**

1. Andrews, L.A., and Shivamoggi B.K., "Integral Transforms for Engineers and Applied Mathematicians," MacMillan, New York, 1988.
2. Narayanan, S., Manikavasagom Pillai, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
3. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.

## AT 2301 KINEMATICS OF MACHINES

L T P C  
3 1 0 4

### GOAL

To expose the student to understand the concept of mechanism of machines.

### OBJECTIVES

The course should enable the student to:

1. Provide an understanding of the kinematics and kinetics of simple machine elements and devices.
2. Provide an understanding and appreciation of the variety of elements employed within a modern complex machine, such as an automobile, together with some historical precedents.
3. Gain knowledge rigid body dynamics (kinematics) of linkages.
4. Design of four bar mechanisms, the direct relevance of problems discussed to engineering practice.
5. Validation of certain theoretical models through laboratory experiments.

### OUTCOME

The students should be able to:

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

### UNIT I BASICS OF MECHANISMS

12

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

### UNIT II KINEMATICS

12

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

### UNIT III CAMS

12

Classifications - Displacement diagrams-parabolic, Simple harmonic and Cycloidal motions - Layout

of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

**UNIT IV GEARS**

**12**

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

**UNIT V FRICTION**

**12**

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

**TOTAL : 60**

**TEXT BOOKS**

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

**REFERENCES**

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

**AT 2302 APPLIED THERMODYNAMICS**

**L T P C**  
**3 1 0 4**

**GOAL**

To expose the student to understand the concept of first law and second law of thermodynamics and their applications, the various power cycles and their applications, Air compressors and their performance evaluation fundamentals of heat transfer.

**OBJECTIVES**

The course should enable the student to :

1. Understand the principles of thermodynamics and the applications of first and second law of thermodynamics.

2. Grasp the concepts of heat engine and heat pump
3. Understand the concept of gas power cycle,
4. Understand the vapour power cycle and refrigeration cycles.
5. Understand the concept of heat transfer with their applications.

### **OUTCOME**

The students should be able to :

1. Describe the principles of first and second law of thermodynamics.
2. Identify and describe the gas power cycles, vapour power cycles and refrigerator cycles.
3. Identify and describe the vapour power cycles and refrigerator cycles.
4. Describe the performance of reciprocating air compressors.
5. Apply the concepts of heat transfer to the real time applications.

### **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 CYCLE 12**

Air standard Brayton cycle with inter-cooling, 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 vapour compression refrigeration system, T-S, P-H diagrams, simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant.

### **UNIT V FUNDAMENTALS OF HEAT TRANSFER 12**

Modes of heat transfer, Fourier's law of conduction, one dimensional steady state conduction through plane and composite walls, cylinders and spheres. Free and forced convection, dimensionless numbers, thermal boundary layer, heat transfer co-efficient, simple problems in fins, heat transfer between fluids separated by plane and cylindrical walls, overall heat transfer coefficient, heat



exchangers, LMTD, concept of radiation- Planck's law, Wien's displacement law, Stefan Boltzmann law, Black body and Grey body radiation.

**TOTAL: 60**

#### **TEXT BOOKS**

1. R.K.Rajput - "A Textbook of Engineering thermodynamics"- Laxmi Publications (P) Ltd, New Delhi-2001.
2. Biray K. Dutta - "Heat Transfer Principles and Applications"- Printice hall of India, New Delhi-2003
3. R.Rudramoorthy - "Thermal Engineering" - Tata McGraw Publishing Co. Ltd, New Delhi 2003
4. P.K. Nag - "Engineering Thermodynamics" Tata McGraw Hill.-2005

#### **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.

### **AT2303 PRODUCTION TECHNOLOGY- II**

**L T P C**  
**3 0 0 3**

#### **GOAL**

To expose the student to understand the concept of first law and second law of thermodynamics and their applications, the various power cycles and their applications, Air compressors and their performance evaluation fundamentals of heat transfer.

#### **OBJECTIVES**

The course should enable the student to :

1. understandtheconceptandbasicmechanicsofmetalcutting,workingofstandard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
2. Understandtheconcepts of various machining process involved in sowing and broaching.
3. completed the module, gain the knowledge ofBasics in metal cutting,
4. understand various types of machine tools used in the Industry and their application.
5. Understand basic concepts of CNC machine and CNC programming.

## OUTCOME

The students should be able to :

1. Select the cutting tools required for various machining operations;
2. Select the proper machine tools for a particular operation
3. Define the concepts of CNC and programme.
4. Define the basic concepts of abrasive processes, gear cutting.
5. Write the codes for CNC operation.

### **UNIT I THEORY OF METAL CUTTING 9**

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

### **UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 9**

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

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

### **UNIT III RECIPROCATING AND MILLING MACHINES 9**

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

### **UNIT IV ABRASIVE PROCESS, SAWING, BROACHING AND GEAR CUTTING 9**

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

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

### **UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 9**

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

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

**TOTAL: 45**

## TEXT BOOKS

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

## REFERENCES

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

## AT 2304 AUTOMOTIVE ENGINES

L T P C  
3 0 0 3

## GOAL

To impart knowledge in development of engine technologies.

## OBJECTIVES

The course enables the students to :

1. Penetrate deep into engine classification, construction and operation of IC engines with latest technologies
2. Grasp the importance SI and CI engine application in automobiles
3. Understand the performance parameters and testing methodologies.
4. Understand the necessity of Ignition system SI engines
5. Understand the combustion process for both SI and CI engines, the concepts of Governors, Fuel pump, Fuel Injectors.

## OUTCOME

The students should be able to :

1. Describe SI and CI engine system application in automobiles.
2. Grasp the basic engine terminologies
3. Differentiate the fuel dynamics for SI and CI engines and define the key terms such as carburetion, stoichiometric ratio, etc.,
4. To design combustion chambers for diesel engines with reference to variable compression ratios
5. Analyze the air dynamics within the combustion chamber and Determine the performance characteristics for both SI and CI engines theoretically.

## UNIT I CONSTRUCTION AND OPERATION

9

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles.

**UNIT II SI ENGINES****9**

Air fuel ratio requirements - Carburetion - types of Carburetor. Function of Components Spark plug, Ignition System - battery coil, magneto coil, Electronic. Combustion in SI Engines - Combustion Chambers, Stages of Combustion - factors affecting flame propagation, Knock in SI engines, variables affecting knocking. Injection in SI Engines.

**UNIT III CI ENGINES****9**

Diesel fuel injection system, Function of Components, Jerk type pump, Distributor pump, Mechanical and pneumatic Governor, Fuel Injector, Types of nozzle, importance of Swirl, Squish, Turbulence air motion, Combustion in CI Engines - Combustion Chambers, Stages of Combustion, Factors affecting Ignition Delay, Knock in CI engines.

**UNIT IV AUXILIARY SYSTEMS****9**

Types of supercharging and turbo charging, relative merits, matching of turbocharger, cooling system - types of cooling systems- air and liquid cooling systems. Thermo syphon and forced circulation and pressurized cooling systems - Lubrication System - Requirements of lubrication systems. Types- mist, pressure feed, dry and wet sump systems. Properties of lubricants.

**UNIT V PERFORMANCE TESTING AND MODERN ENGINE TECHNOLOGY****9**

Necessity and limitations, charge cooling, Basic Performance Parameters, Performance Characteristics, factors affecting performance Characteristics, Performance Maps - SI and CI engines, Heat balance Test, Morse Test. Introduction to modern engine technologies - Lean Burn Engines, Stratified Charged Engines, Low heat Rejection Engines, Homogeneously Charged Compression Ignition Engines

**TOTAL: 45****TEXT BOOKS**

1. Internal Combustion Engines by V. Ganesan, 2007, Tata Mc Graw Hill
2. Ramalingam K.K., "Internal Combustion Engines", Sci-Tech Publications, 2005.

**REFERENCES**

1. Advanced Engine Technology by Heisler, SAE Publication
2. Edward F. Obert Internal Combustion Engines
3. H.N. Gupta Fundamentals of Internal Combustion Engines by, PHI
4. Mathur and Sharma Intendamental Combustion Engines Dhanpat Rai and Sons 2002
5. John B. Heywood, "Fundamentals of Internal Combustion Engines"

## AT 2331 COMPUTER AIDED MACHINE DRAFTING LABORATORY

L T P C  
0 0 3 2

### GOAL

The student will be able to know about the software Autocad and to know about its applications for drafting and assembling of various mechanical and engine components.

### OBJECTIVES

The subject should enable the student to :

1. Know about the basics of drafting of engine and mechanical components using autocad software.
2. Know about the basics of drafting and assembling of engine and mechanical components using autocad software.

### OUTCOME

The students should be able to :

1. Draw the various components such as piston, connecting rod, crankshaft, IC engine valves, spark plug as per the dimensions given or provided.
2. Draw the various components and assemble it with components such as piston-connecting rod, screw jack, Ram's bottom safety valve assembly, plummer block, steam engine cross head assembly.

### LIST OF EXPERIMENTS

1. Drawing of automobile components such as piston, connecting rod, valves, crank shaft, spark plug. (15 Hours)
2. Assembly drawing of screw jack, piston - connecting rod assembly, Ram's bottom safety valve assembly, Plummer block, steam engine cross head. (30 Hours)

**TOTAL : 45 Hours**

### The List of Equipments for a Batch of 30 Students

1. Computer nodes - 30 Nos.  
Software like AutoCAD - 30 licenses

## AT 2332 AUTOMOTIVE ENGINE COMPONENTS LABORATORY

L T P C  
0 0 3 2

### GOAL

To impart knowledge in various engine components

### OBJECTIVES

The course enables the students to :

1. Experience the skill of dismantling and assembling of engines.
2. Have a detailed study about Engine parts
3. Determine the dimensions of crankshaft, camshaft, valves etc
4. Examine the malfunctioning of the system
5. Understand the mounting of components, the basic working principle of components with the engine for accurate operations.

### OUTCOME

The students should be able to :

1. Completely dismantle and assemble the engines
2. Calculate the Engine displacement by measuring the Stroke length, bore.
3. Visually inspect for wear and tear in the components
4. Measure the ovality in crank journals, and cylinder bore and compare with the standard specifications
5. Study the components of cooling systems and lubrication systems, Differentiate the conventional ignition and Electronic ignition system.

### LIST OF EXPERIMENTS

1. Dismantling of 4 cylinder petrol engine. (6 Hours)
2. Assembling of 4 cylinder petrol engine. (6 Hours)
3. Dismantling of 6 cylinder diesel engine. (6 Hours)
4. Assembling of 6 cylinder diesel engine. (6 Hours)
5. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI (3 Hours)
6. Study of ignition system components - coil, magneto and electronic ignition systems. (3 Hours)
7. Study of engine cooling system components (3 Hours)
8. Study of engine lubrication system components (3 Hours)
9. Ovality and taper measurement of cylinder bore and comparison with standard specifications (9 Hours)

10. Ovality and taper measurement of engine crank shaft and comparison with standard specification .

**TOTAL : 45 Hours**

**List of Equipments ----- Each 1 No(for a batch of 30 students)**

1. Four cylinder petrol engine
2. Six cylinder diesel engine
3. Fuel filter, fuel injection pump, injector, carburetor, MPFI component
4. Ignition coil, magneto, electronic ignition system components
5. Water pump, thermostat, radiator, temperature gauge
6. Lub oil pump, pressure relief valve, filter, oil pressure gauge
7. Internal micrometer, external micrometer, dial gauges

**AT 2333 ENGINE TESTING LABORATORY**

**L T P C**  
**0 0 3 2**

**GOAL**

The students will be able to understand the list of the experiments and the various types of equipment.

**OBJECTIVES**

The course should enable the student to :

1. Understand the Working principle of hydraulic, electrical and eddy current dynamometers
2. Understand the Valve timing and port timing diagram
3. Understand the Importance of Performance Testing of IC Engines.

**OUTCOME**

The students should be able to :

1. Carryout the Experiment to determine the Performance of Various IC engines
2. Define the Engine Parameters and their effects over the Performance
3. Determine the P- $\theta$  and P-V Values

**List of Experiments**

1. Study of hydraulic, electrical and eddy current dynamometers (3 Hours)
2. Valve timing and port timing diagram (3 Hours)
3. Performance test on two wheeler SI engine (3 Hours)

- |     |   |            |
|-----|---|------------|
| 4.  | Performance test on automotive multi-cylinder SI engine   | (3 Hours)  |
| 5.  | Performance test on automotive multi-cylinder CI engine   | (3 Hours)  |
| 6.  | Retardation test on I.C. Engines.   | (6 Hours)  |
| 7.  | Heat balance test on automotive multi-cylinder SI engine  | (3 Hours)  |
| 8.  | Heat balance test on automotive multi-cylinder CI engine  | (3 Hours)  |
| 9.  | Morse test on multi-cylinder SI engine  | (6 Hours)  |
| 10. | Study of P-? and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder. | (12 Hours) |

**TOTAL : 45 HOURS**

**The list of equipments ----- each 1 no(for a batch of 30 students)**

1. Hydraulic dynamometer
2. Eddy current dynamometer
3. Electrical dynamometer
4. Single cylinder two stroke cut section engine
5. Single cylinder four stroke cut section engine
6. Two-wheeler engine test rig.
7. Automotive multi-cylinder SI engine test rig with heat balance arrangement
8. Automotive multi-cylinder CI engine test rig with heat balance arrangement

**AT 2334 PRODUCTION TECHNOLOGY LABORATORY**

**L T P C**  
**0 0 3 2**

**GOAL**

To expose the students to the common & most widely used manufacturing processes such as Cutting, Milling, Grinding, Machining and also the basic working of the Lathes.

**OBJECTIVES**

The subject should enable the student to:

1. Know about Two or More Metal Cutting process.
2. Gain knowledge about one or more processes in Milling Machines.
3. Understand two or more processes in Grinding / Abrasive machining.
4. Machine Two or More Components for Assembly of different fits and also the process of machining gears.
5. Do basic work on Capstan or Turret Lathes, Work on One or More process in CNC Machines.



## OUTCOME

The students should be able to :

1. Work on a few Metal Cutting process such as Shear Angle Measurement, Cutting Force Measurement, Cutting Temperature Measurement, Tool Wear Measurement, Life Measurement
2. Work on a Milling Machine to do operations such as Milling Polygon Surfaces, Gear milling, Keyway milling, Helical Groove milling.
3. Do Grinding / Abrasive machining such as Surface Grinding, Cylindrical Grinding, Centreless Grinding, Lapping, and Honing etc
4. Machine Components for Assembly of different fits such as Machining using Lathes, Shapers, Drilling, Milling and Grinding Machines.
5. Operate Capstan or Turret Lathes, finish a few operations in Gear Machining such as Gear Cutting, Gear Shaping & Gear Hobbing, Work & do a few basic operations in CNC Machines such as CNC Programming, CNC Tooling, CNC Machining.

## EXERCISES

1. Two or More Metal Cutting Experiments (Example: Shear Angle Measurement, Cutting Force Measurement, Cutting Temperature Measurement, Tool Wear Measurement, Life Measurement etc.) (6 Hours)
2. One or More Exercises in Milling Machines (Example: Milling Polygon Surfaces, Gear milling, Keyway milling, Helical Groove milling etc.) (6 Hours)
3. Two or More Exercises in Grinding / Abrasive machining (Example: Surface Grinding, Cylindrical Grinding, Centreless Grinding, Lapping, Honing etc.) (6 Hours)
4. Two or More Exercises in Machining Components for Assembly of different fits. (Example: Machining using Lathes, Shapers, Drilling, Milling, Grinding Machines etc.) (6 Hours)
5. One or More Exercises in Capstan or Turret Lathes (6 Hours)
6. One or More Exercises in Gear Machining (Example: Gear Cutting, Gear Shaping, Gear Hobbing etc.) (6 Hours)
7. One or More Exercises in CNC Machines (Example: CNC Programming, CNC Tooling, CNC Machining etc.) (9 Hours)

**TOTAL : 45 HOURS**

## List of Equipments(for a batch of 30 students)

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

## SEMESTER - IV

### ME 2402 STRENGTH OF MATERIALS

L	T	P	C
3	1	0	4

#### GOAL

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

#### OBJECTIVES

The course should enable the students to :

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

#### OUTCOME

The students should be able to:

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

#### UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

12

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

#### UNIT II BEAMS - LOADS AND STRESSES

12

Types of beams: Supports and Loads - Shear force and Bending Moment in beams - Cantilever, Simply supported and Overhanging beams - Stresses in beams - Theory of simple bending - Stress variation along the length and in the beam section - Effect of shape of beam section on stress induced - Shear stresses in beams.

#### UNIT III TORSION

12

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

**UNIT IV BEAM DEFLECTION****12**

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

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

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

**TOTAL: 60****TEXT BOOKS**

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

**REFERENCES**

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

**AT 2401 DYNAMICS OF MACHINES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**GOAL**

To expose the student to understand the concept of the dynamic analysis of the machines.

**OBJECTIVES**

The course should enable the student to:

1. Understand the principles in mechanisms of Machines, force-motion characteristics of standard mechanisms, the undesirable effects of unbalances resulting from prescribed motions in mechanism
2. Understand the force-motion relationship in components subjected to External Forces
3. Analyse the force-motion characteristics of standard mechanisms

4. Study the undesirable effects of unbalances resulting from prescribed motions in mechanism.
5. Visualize the effect of Dynamics of Undesirable Vibrations, the principles in mechanisms used for governing of Machines.

### **OUTCOME**

The students should be able to:

1. Analyse the Forces of Mechanisms and Balancing.
2. Free and Forced Vibration of Single degree of freedom systems.
3. Understanding of rigid body dynamics (kinematics) of linkages, design of four bar mechanisms, gyroscopic devices.
4. Understand the existing theory of mechanism, together with its shortcomings, the concepts of mobility, degrees of freedom and inertia and be able to understand how these apply to simple mechanisms and machines;
5. Calculate forces and accelerations in mechanisms, Apply typical analytical and graphical techniques, reinforcing and expanding Part I learning, to a variety of mechanical engineering components and systems.

### **UNIT I FORCE ANALYSIS OF MECHANISMS 12**

Static, Inertia and combined force analysis - graphical and analytical method - slider crank mechanism and four bar mechanism, turning moment diagram and flywheel - applications in engine, punching presses.

### **UNIT II BALANCING 12**

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

### **UNIT III FREE VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS 12**

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

### **UNIT IV FORCED VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS 12**

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

### **UNIT V MECHANISMS FOR CONTROL 12**

Governors:Types - Centrifugal governors-Gravity controlled and spring controlled centrifugal governors - Characteristics - Effect of friction - Controlling Force - other Governor mechanisms.

Gyroscopes: Gyroscopic forces and Torques - Gyroscopic stabilization- Gyroscopic effects in Automobiles, ships and airplanes

**TOTAL: 60**

### **TEXT BOOKS**

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

### **REFERENCES**

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

### **AT2402 FLUID MECHANICS AND MACHINERY**

**L T P C**  
**3 1 0 4**

### **GOAL**

- Understand the structure and the properties of the fluid.
- Understand and appreciate the complexities involved in solving the fluid flow problems.
- Understand the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.
- Understand the energy exchange process in fluid mechanics handling incompressible fluids.

### **OBJECTIVES**

The course should enable the student to:

- 1 Understands the basic concept and properties of fluid.
- 2 Understand fluid kinematics analysis like flow visualization , lines of flow ,types of flow ,velocity field and fluid dynamics analysis like equations of motion, Euler's equation along a streamline, Bernoulli's equation(application).
- 3 Understand the concept of incompressible fluid flow.
4. Understand the euler's equation for turbo machines and also to understand the performance for turbines.
5. Understand the velocity triangles, specific speed, efficiency and performance of pumps.

6. Understand the basic concept like fluid definition, distinction between solid and fluid, units and dimensions.
7. Understand the properties of fluids like density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension.
8. Understand the Fluid statics like concept of fluid static pressure, absolute and gauge pressures.
9. Understand the Fluid Kinematics like flow visualization, lines of flow, types of flow, velocity field and acceleration.
10. Understand the concept of incompressible fluid flow like Viscous flow by analysing Navierstoke's equation, Shear stress, pressure gradient relationship.
11. Understand the Euler's equation for turbo machines by construction of velocity, vector diagram's, head and specific work, components of energy transfer, degree of reaction.
12. Understand Hydro turbines definition and classifications like Pelton turbine ,Francis turbine, propeller turbine, Kaplan turbine.

### OUTCOME

The students should be able to:

1. Describe pressure measurements by manometers and pressure gauges.
2. Describe continuity equation (one and three dimensional differential forms), equation of streamline, stream function, velocity potential function, circulation, flow net.
3. Understand fluid dynamics like equations of motion, Euler's equation along a streamline, Bernoulli's equation and its application like Venturimeter, Orifice meter, Pitot tube.
4. Describe Buckingham's theorem and its application.
5. Describe laminar flow between parallel plates and Laminar flow through circular tubes (Hagen poiseulle's).
6. Describe Darcy - weisback's equation, pipe roughness, friction factor, Moody's diagram.
7. Describe the flow through pipes in series and in parallel.
8. Describe Boundary layer flows, boundary layer thickness and boundary layer separation.
9. Describe the Fluid machines by definition and classification
10. Describe working principles, velocity triangles, work done, specific speed, efficiencies and performance curve for turbines.
11. Explain the Pump definition and classifications like Centrifugal pump with working principles, velocity triangles, specific speed, efficiency and performance curves and Reciprocating pump with working principles, indicator diagram, work saved by air vessels and performance curves
12. Describe cavitations in pumps Understand concept of rotary pumps and type andworking principle of gear and vane pumps.

### UNITI BASIC CONCEPTS AND PROPERTIES

12

Fluid - definition, distinction between solid and fluid - Units and dimensions - Properties of fluids -

density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour 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 - Venturimeter, Orificemeter, Pitot tube - dimensional analysis - Buckingham's 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** **12**

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - 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** **12**

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

**TOTAL: 60**

**TEXT BOOKS**

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
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. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmipublications (P) Ltd., New Delhi, 1995.
2. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpa Rai and Sons, Delhi, 1998.
4. Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2004.

## AT 2403 AUTOMOTIVE CHASSIS

L T P C  
3 0 0 3

### GOAL

All automobiles have important driveline and structural components. This subject deals with the functions and constructional details of all the chassis components.

### OBJECTIVES

The course should enable the student to:

1. Understand various types of layout of vehicles and features and applications.
2. Understand the construction, materials and various types of frames with knowledge on loads acting on frames and testing of frames.
3. Know about the construction, materials and types of front axles.
4. Conceive the significance of front wheel and steering geometry and study steering layouts, steering gear boxes and steering systems.
5. Understand the construction and working of drive line system, final drives, differentials, rear axles, wheels and tires, suspension and brake systems.

### OUTCOME

The students should be able to :

1. Differentiate various layouts, analyze the merits and limitations and apply in real time, Analyze frames for real time applications, Dismantle, study, perform corrections and assemble front axles.
2. Dismantle, study, rectify and assemble drive line system, final drive and differential, rear axle, wheels and tires, suspension and brake systems, Realize effects of driving torque, rear end torque, wheel wobble, wheel hop, wheel shimmy, slip angle and turning circle radius.
3. Describe the operation of steering system of crawler tractors and electronic steering system, Be familiar with Ackermann steering system and aware of under steering, over steering, reversible steering and irreversible steering, Realize the inter dependence steering system, brake system and suspension system.



4. Be familiar with various types of springs, design of springs, rigid and independent and compensated suspension systems,
5. Be familiar with various types of rear axles, brake systems, final drives ,ABS and differential', Create virtual and real vehicle models and perform testing.

**UNIT I INTRODUCTION 9**

Types of chassis layout with reference to power plant locations and drives, vehicle frames, various types of frames, monocoque structure, constructional details, materials, testing of vehicle frames, unitized frame body construction.

**UNIT II FRONT AXLE AND STEERING SYSTEM 9**

Types of front axles, construction details, materials, front wheel geometry: castor, camber, king pin inclination, toe-in. conditions for true rolling motion of wheels during steering, steering geometry, Ackermann steering system, constructional details of steering linkages, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble, power assisted steering, steering of crawler tractors and Electronic Steering System.

**UNIT III DRIVE LINE 9**

Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit, non-slip differential, differential locks, differential housings, construction of rear axles, types of loads acting on rear axles, fully floating, three quarter floating and semi floating rear axles, rear axle housing, construction of different types of axle housings, multi axle vehicles, wheels and tyres.

**UNIT IV SUSPENSION SYSTEM 9**

Need of suspension system, types of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs, independent suspension, rubber suspension, pneumatic suspension, shock absorbers, semi-active and active suspension system.

**UNIT V BRAKING SYSTEM 9**

Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, concept of dual brake system, parking brake, material, hydraulic system, vacuum assisted system, air brake system, antilock braking, retarded engine brakes, eddy retarders and electronic braking system.

**TOTAL: 45**

**TEXT BOOKS**

1. Heldt.P.M.- "Automotive Chassis"- Chilton Co., New York- 1990
2. Steed W - "Mechanics of Road Vehicles"- Illiffe Books Ltd., London- 1960

**REFERENCES**

1. Newton Steeds and Garrot- "Motor Vehicles"- Butterworths, London- 2000.

2. Judge A.W- "Mechanism of the Car"- Chapman and Halls Ltd., London- 1986
3. Giles.J.G- "Steering, Suspension and tyres"- Iiiffe Book Co., London- 1988.
4. Crouse W.H- "Automotive Chassis and Body"- McGraw-Hill, New York- 1971.
5. K.K.Ramalingam - "Automobile Engineering" - Scitech Publication, Chennai - 2001.

### **AT 2404 AUTOMOTIVE TRANSMISSION**

**L T P C**  
**3 0 0 3**

#### **GOAL**

To impart knowledge about the critical importance of the transmission system in an automobile and to create awareness about the evolution, components involved and different types of transmission system widely used in automobiles.

#### **OBJECTIVES**

The subject should enable the student to

1. Understand various types of Gear Box, its principle and applications.
2. Understand the construction, principle and the concept of Fluid Coupling & Torque Converter.
3. Know about the concept of epicyclic gear system and its types, overdrives.
4. Gain knowledge about the concepts of hydrostatic drive, its merits & demerits and the electric drive commonly used in buses
5. Understand the construction and working of the most commonly used automatic transmission systems and its advantage over the conventional transmissions.

#### **OUTCOME**

The students should be able to

1. Differentiate various types of gearbox, its working, its advantages & its limitations, Analyze gear ratios for various types of gear boxes for real time applications, Be familiar with epicyclic gear trains, its types, operations, merits & demerits.
2. Describe and analyze the operation of Fluid Coupling & Torque convertor. Realize the performance & output of the Fluid Coupling & Torque convertor under various parameters.
3. Describe the need, working, construction and the principle of overdrives. Describe the concept of hydrostatic drive & be familiar with Jannys hydrostatic drive and also its merits & demerits.
4. Explain the concepts of electric drive & commonly used electric drive in buses. Be familiar with the commonly used automatic transmission systems and to describe the construction & working of the same.
5. Explain the advantages of automatic transmission over the conventional systems.

#### **UNIT I GEAR BOX**

**9**

Gear Box: method of calculation of gear ratios for vehicles, performance characteristics in different

speeds, different types of gear boxes, speed synchronizing devices, gear materials, lubrication.

**UNIT II HYDRODYNAMIC DRIVE 9**

Fluid coupling: advantages and limitations, construction details, torque capacity, slip in fluid coupling, performance characteristics. Means used to reduce drag torque in fluid coupling.

Principal of torque conversion, single, multi stage and poly-phase torque converters, performance characteristics, constructional and operational details of typical hydraulic transmission drives.

**UNIT III AUTOMOTIVE TRANSMISSION 9**

All spur and internal gear type planetary gearboxes, Ford T-model, Cotal and Wilson Gear box, determination of gear ratios, automatic overdrives.

**UNIT IV HYDROSTATIC DRIVE AND ELECTRIC DRIVE 9**

Hydrostatic drives: advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives, Janney Hydrostatic drive.

Electrical drives: advantages and limitations, principles of Ward Leonard system of control Modern electric drive for buses and performance characteristics.

**UNIT V AUTOMATIC TRANSMISSION APPLICATIONS 9**

Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, Ford and Chevrolet drive, automatic control of gear box, Electronically Controlled Transmission and CVT. Case study for the Transmission of Nissan, Mercedes Benz, Toyota

**TOTAL: 45**

**TEXT BOOKS**

1. Heldt P.M - Torque converters- Chilton Book Co.-1992
2. Newton and Steeds - Motor Vehicle- Illiff Publisher- 2000

**REFERENCE**

1. Design Practices, passenger Car Automotive Transmissions- SAE Hand book- 1994.

## AT 2431 FLUID MECHANICS AND MACHINERY LABORATORY

L T P C  
0 0 3 2

### GOAL

To find the performance of pump like centrifugal pump, reciprocating pump, Gear pump. To find the coefficient of discharge of orifice meter and venturimeter. Conducting the characteristic curves of Kaplan turbine, Francis turbine and Pelton wheel.

### OBJECTIVES

The course should enable the student to:

1. Understands the properties of the fluid and also to learn about the pressure and velocity of the flowing fluid using venturimeter, orifice meter.
2. Understand the discharge of fluid by using pump like centrifugal, reciprocating and gear pump and also to find the rate of flow using rotameter.
3. Understand the efficiency of turbine like Kaplan and Francis.
4. Understand the change in pressure (friction factor) of given set of pipes.
5. Understand the efficiency of Pelton wheel.

### OUTCOME

The students should be able to:

1. Determine the coefficient of discharge of orifice meter and venturimeter.
2. Conduct experiments and draw the characteristic curves of centrifugal pump, submergible pump, reciprocating pump, Gear pump and also can find the discharge of the pump.
3. Conduct experiments and draw the characteristics curves of Francis turbine and Kaplan turbine and also can find the efficiency of the turbine.
4. Conduct experiments and draw the characteristics curves of Pelton wheel.
5. Determine the friction factor of given set of pipes when there is change in pressure. Calculate the rate of flow using Rotameter.

### LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter. (6 hours)
2. Determination of the Coefficient of discharge of given Venturi meter. (6 hours)
3. Calculation of the rate of flow using Rotameter. (6 hours)
4. Determination of friction factor of given set of pipes. (6 hours)
5. Conducting experiments and drawing the characteristic curves of centrifugal pump /submergible pump (6 hours)
6. Conducting experiments and drawing the characteristic curves of reciprocating pump. (3 hours)

7. Conducting experiments and drawing the characteristic curves of Gear pump. (3 hours)
8. Conducting experiments and drawing the characteristic curves of Pelton wheel. (3 hours)
9. Conducting experiments and drawing the characteristics curves of Francis turbine.(3 hours)
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine. (3 hours)

**TOTAL : 45 HOURS**

**List of Equipment(For the batch of 30 students)**

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup Kaplan turbine setup

**AT 2432 AUTOMOTIVE CHASSIS COMPONENTS LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**GOAL**

To impart knowledge in vehicle frame structure and chassis components.

**OBJECTIVES**

The course enables the students to :

1. Have a detailed study about chassis parts
2. Experience the skill of dismantling and assembling of Axles, differential, gear box and transfer case
3. Experience the skill of measuring the heavy duty vehicle frames and light duty vehicle frames.
4. Examine the malfunctioning of the braking system
5. Understand the necessity of transfer case mechanism for all wheel drive.

**OUTCOME**

The students should be able to :

1. Dismantle and assemble axles, differential, gear box and transfer case.

2. Grasp the knowledge of various mechanism of differentials such as epi- cyclic differential, spur gear differentials etc.,
3. Descry gear box and transfer box, Identify the various types of the springs and their application.
4. Calculate the spring rate and Gain the knowledge of suspension system and its applications
5. Diagnose the faults in brake system and inspect the damage in frame structures.

**List of Experiments:**

**Study and measurement of the following chassis frames: (6 hours)**

1. Heavy duty vehicle frame (Leyland, Tata etc)
2. Light duty vehicle frame (Ambassador, Maruti van etc)

**Study, dismantling and assembling of**

3. Front Axle
4. Rear Axle
5. Differential
6. Steering systems along with any two types of steering gear box
7. Braking systems - hydraulic servo vacuum, compressed air power brakes.
8. Leaf spring, coil spring, torsion bar spring, Hydraulic shock absorber (30 hours)

**Study, Dismantling and Assembling of**

9. Clutch assembly of different types
10. Gear Box
11. Transfer case (9 hours)

**TOTAL : 45 HOURS**

**The List of Equipments ----- Each 1 No (For a Batch of 30 Students)**

1. Heavy duty vehicle chassis frame (Leyland or Tata)
2. Light duty vehicle chassis frame
3. Front axle
4. Rear axle
5. Steering system
6. Steering gear box (Rack and pinion, re-circulating ball type)
7. Hydraulic brake system
8. Air brake system

9. Leaf spring, coil spring, torsion bar
10. Hydraulic shock absorber
11. Diaphragm clutch assembly
12. Gear box (light duty, heavy duty)
13. Transfer case

### **ME 2432 STRENGTH OF MATERIALS LABORATORY**

**L T P C**  
**0 0 3 2**

#### **GOAL**

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

#### **OBJECTIVES**

The course should enable the students to :

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

#### **OUTCOME**

The students should be able to :

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

#### **LIST OF EXPERIMENTS**

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

(iii) Quenched and tempered specimen.

11. Microscopic Examination of

(9 Hours)

(i) Hardened samples and

(ii) Hardened and tempered samples.

**TOTAL : 45 HOURS**

**List of Equipments(for a batch of 30 students)**

1. Universal Tensile Testing machine with double shear attachment - 40 Ton Capacity - 1 No
2. Torsion Testing Machine (60 NM Capacity) - 1 No
3. Impact Testing Machine (300 J Capacity) - 1 No
4. Brinell Hardness Testing Machine - 1 No
5. Rockwell Hardness Testing Machine - 1 No
6. Spring Testing Machine for tensile and compressive loads (2500 N) - 1 No
7. Metallurgical Microscopes - 3 Nos
8. Muffle Furnace (8000C) - 1 No

**AT 2433 PROJECT WORK**

**L T P C**  
**0 0 6 2**

Students should design and develop model of Automobile systems and validate the results. The assessment will be done on a continuous basis as follows :

<b>Review / Exam</b>	<b>Weightage</b>
First Review	10%
Second Review	20%
Third Review	20%
Final Viva- Voce	50%
<b>TOTAL</b>	<b>100%</b>



## SEMESTER-V

### AT 2501 HEAT & MASS TRANSFER

L T P C  
3 1 0 4

#### GOAL

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

#### OBJECTIVES

The course should enable the student to

1. The physical behaviour of various modes of heat transfer, like, conduction, convection and radiation.
2. The application of various experimental heat transfer correlations in engineering calculations.
3. The thermal analysis and sizing of heat exchangers.
4. The basic concept of mass transfer, its types & its correlations.
5. Understand the concepts of Black Body, Grey Body, View factor, Radiation shielding.
6. Understand the concept of Mass transfer, its types & laws associated with it.

#### OUTCOME

The students should be able to

1. Identify the difference between various modes of Heat Transfer.
2. Learn the Resistance Concept used in Heat Conduction.
3. Learn to use the basic methods in Conduction.
4. Apply the concept of Lump Parameter analysis and when it is applicable.
5. Learn the concepts of boundary layer.
6. Learn to apply various correlation used in Convective Heat Transfer. Design/size Heat Exchanger.

#### UNIT I CONDUCTION

12

Basic Concepts - Mechanism of Heat Transfer - Conduction, Convection and Radiation - General Differential equation of Heat Conduction - Fourier Law of Conduction - Cartesian and Cylindrical Coordinates - One Dimensional Steady State Heat Conduction - Conduction through Plane Wall, Cylinders and Spherical systems - Composite Systems - Conduction with Internal Heat Generation - Extended Surfaces - Unsteady Heat Conduction - Lumped Analysis - Use of Heislers Chart.

#### UNIT II CONVECTION

12

Basic Concepts - Convective Heat Transfer Coefficients - Boundary Layer Concept - Types of Convection - Forced Convection - Dimensional Analysis - External Flow - Flow over Plates, Cylinders and Spheres - Internal Flow - Laminar and Turbulent Flow - Combined Laminar and Turbulent - 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 12**

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 12**

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

**UNIT V MASS TRANSFER 12**

Basic Concepts - Diffusion Mass Transfer - Fick's Law of Diffusion - Steady state Molecular Diffusion - Convective Mass Transfer - Momentum, Heat and Mass Transfer Analogy - Convective Mass TransferCorrelations

**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.

**REFERENCES**

1. Ozisik M.N, "Heat Transfer", McGraw-Hill Book Co., 1994.
2. Nag P.K, "Heat Transfer", Tata McGraw-Hill, New Delhi, 2002.
3. Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, 2000.
4. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998.
5. Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.

## AT 2502 AUTOMOTIVE MATERIALS & METALLURGY

L T P C  
3 0 0 3

### GOAL

This subject introduces to the students the structure, properties, treatment, testing and applications of metals and on non-metallic materials so as to identify and select suitable materials for various engineering applications.

### OBJECTIVES

The course should enable the students to,

1. Understand the constitutions of alloys and phase diagrams. Impart knowledge on the different types of composite materials, their properties and applications.
2. Understand the polymer matrix composites, different thermoplastic and thermosetting resin, different plastics used in thermosetting.
3. Understand the Characteristics and microstructures of various types of cast irons and steels.
4. Understand the ceramics and composites and various types of Ceramic Matrix composites.
5. Understand the phase diagrams of steels and iron carbon systems and various reactions like eutectic, peritectic, eutectoid etc.
6. Understand the mechanical, physical and chemical properties of various metals and its testing methods.

### OUTCOME

The students should be able to

1. Describe the Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron - Iron carbide equilibrium diagram.
2. Analyse the classification of steel and cast Iron micro-structure, properties and application.
3. Analyse the Characteristics of polymer matrix composites. Polymer matrix resins like Thermosetting resins and thermoplastic resins and Reinforcement of fibres in polymer matrix composites.
4. Describe the types of Polymers Polymers ,commodity and engineering polymers.
5. Describe the some of the plastic forming processes like compression moulding ,resin transfer moulding,injection moulding pultrusion, filament winding.
6. Analyse the Characteristics and Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test.

### UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

9

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

**UNIT II HEAT TREATMENT****9**

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

**UNIT III SELECTION OF MATERIALS****9**

Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring. Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel, radiator, brake lining.

**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 deliyses - Engineering Ceramics - Properties and applications of Al<sub>2</sub>O<sub>3</sub>, SiC, SiC, Si<sub>3</sub>N<sub>4</sub>, PSZ and Sialon - Fibre and particulate reinforced composites.

**UNIT V MECHANICAL PROPERTIES AND TESTING****9**

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

**TOTAL: 45****TEXT BOOKS**

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

**REFERENCES**

1. William D. Callister "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.

## AT 2503 AUTOMOTIVE ELECTRICAL AND ELECTRONICS

L T P C  
3 0 0 3

### GOAL

To impart knowledge in Automotive Electrical and Electronics

### OBJECTIVES

The course should enable the student to

- 1 Understand construction and working of batteries and accessories
- 2 Understand the working of starting system.
- 3 Understand the working of charging system
4. Understand the fundamentals of automotive electronics
5. Understand the working of sensors and activators

### OUTCOME

The students should be able to

- 1 Describe the working of lead acid battery. The operation of lighting system, Horn and Wiper system
2. Describe the condition at starting and behavior of starter during starting and the working and Maintenances of starter motor.
3. Describe the working of different starter drive units and the working of onboard diagnostic system, security and warning system.
4. Describe the shunt generator characteristics, working of alternators and bridge rectifiers. Aware of current trends in automotive electronics engine management system.
5. Describe the working of speed sensor, throttle position sensor, exhaust oxygen level sensor, manifold pressure sensor, crankshaft position sensor, coolant temperature sensor, air mass flow sensor. The working of solenoids, stepper motors and relays.

### UNIT I BATTERIES AND ACCESSORIES

9

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, headlight dazzling and preventive methods - Horn, wiper system and trafficator.

### UNIT II STARTING SYSTEM

9

Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.

### UNIT III CHARGING SYSTEM

9

Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation,

cutout, Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.

**UNIT IV FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9**

Current trends in automotive electronic engine management system, electro magnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system.

**UNIT V SENSORS AND ACTUATORS 9**

Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

**TOTAL : 45**

**TEXT BOOKS**

1. Young A.P. & Griffiths. L. "Automotive Electrical Equipment", ELBS & New Press- 1999.
2. William B.Riddens "Understanding Automotive Electronics", 5th edition - Butter worth Heinemann Woburn, 1998.
3. Crouse, W.H "Automobile Electrical Equipment", McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.

**REFERENCES**

1. Bechhold "Understanding Automotive Electronics", SAE, 1998.
2. Judge A.W "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992.
3. Kholi.P.L "Automotive Electrical Equipment", Tata McGraw-Hill Co., Ltd., New Delhi, 1975.
4. Robert Bosch "Automotive Hand Book", SAE (5th Edition), 2000.
5. Ganesan.V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New.

**AT 2504 TWO AND THREE WHEELERS**

**L T P C**  
**3 0 0 3**

**GOAL**

The aim of this subject is to make the students to know and understand the constructional details operating characteristics and vehicle design aspects.

**OBJECTIVES**

The course should enable the students to :

1. Understand the Two stroke SI engine, four stroke SI engine; merits and demerits. Symmetrical and unsymmetrical port timing diagrams.

2. Understand the Types of scavenging processes, Fuel system, Lubrication system. Magneto coil and battery coil spark ignition system.
3. Understand the construction and working of electronic ignition system, starting system; kick starter system.
4. Understand the types of clutches, gear box and shock absorbers etc.
5. Understand the types of brakes, wheels, tyres and tubes.
6. Understand the constructions and case studies of two and three wheelers and maintenance of vehicles.

**UNIT I POWER UNIT 9**

Two stroke SI engine, four stroke SI engine; merits and demerits. Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes; merits and demerits, 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 9**

Mainframe and 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, WHEELS AND TYRES 9**

Drum brakes, Disc brakes, Front and rear brake links, Layouts. Spoked wheel, Cast wheel, Disc wheel, Disc types. Tyres and tubes.

**UNIT IV TWO WHEELERS 9**

Case study of major Indian models of motorcycles, scooters and mopeds. TVS mopeds and motorcycles, Hero Honda motorcycles, Bajaj scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

**UNIT V THREE WHEELERS 9**

Case study of Indian models. Auto rickshaws, Pickup van, Delivery van and trailer. Maintenance: daily, Weekly, Monthly, Fault tracing.

**TOTAL: 45**

**TEXT BOOK**

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

**REFERENCES**

1. The Cycle Motor Manual - Temple Press Limited, London - 1990
2. Encyclopedia of Motorcycling - 20 volume Marshall, Cavensih, UK - 1989
3. Brayant R.V,Vespa - Maintenance and Repair Series - S.Chand & Co., New Delhi -1986.
4. Raymond Broad Lambretta - A Practical Guide to maintenance and repair - S.Chand & Co., New Delhi - 1987.

## AT 2505 AUTOMOTIVE ENGINE COMPONENTS DESIGN

L T P C  
3 1 0 4

### GOAL

To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

### OBJECTIVES

The subject should enable the student to:

1. Know about various types of materials, properties of materials and various applications of the materials, and computer aided application.
2. Know about the fits, clearance and tolerances concepts, also the design of the helical springs.
3. know about design procedure to design piston and its parts, cylinder and cylinder block, lubrication of piston assembly.
4. Understand the designing the parts of connecting rod and crankshaft, know about the materials of connecting rod and crankshaft, and also know about the balancing of crankshaft.
5. Understand the design aspects of Inlet and exhaust valves, valve mechanism, and also the materials for the valves.

### OUTCOME

The students should be able to:

1. Know about the types of materials and material properties, Application of the materials, CAD application in the Automobile industry and Differentiate between the concepts of Fits, Clearance and Tolerance.
2. Design the helical springs and its application. The cylinder block and cylinder parts based on the engine specification of and also based on the engine application and the piston and its parts based on the engine specification of and also based on the engine application.
3. Design the connecting rod and its parts based on the engine specification of and also based on the engine application. The crankshaft and its parts based on the engine specification of and also based on the engine application also with the balancing weight of the crankshaft.
4. Design the valves and its mechanism for both the inlet and exhaust valve based on the engine specification of and also based on the engine application.
5. Identify the different types of materials used for the manufacturing of the valve and its components.

### UNIT I INTRODUCTION

12

Engineering materials and their physical properties applied to design, selection of materials, factor of safety, endurance limit, notch sensitivity, principles of design optimization, future trends, computer aided drafting.



**UNIT II LIMITS, FITS, TOLERANCES, SURFACE FINISH, SHAFTS AND SPRINGS 12**

Definitions, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, design of power transmission shafts, design of helical springs.

**UNIT III DESIGN OF CYLINDER AND PISTON 12**

Choice of material for cylinder and piston, piston friction, piston slap, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

**UNIT IV DESIGN OF CONNECTING ROD, CRANKSHAFT 12**

Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts, connecting rod failures, balancing of I.C. Engines, significance of firing order, material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations.

**UNIT V DESIGN OF VALVES AND FLYWHEEL 12**

Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train. Materials and design of flywheel.

**TOTAL: 60**

**TEXT BOOKS**

1. R.K. Jain, "Machine Design", Khanna Publishers, New Delhi, 1997.
2. "Design Data Book", PSG College of Technology, Coimbatore, 2000.
3. P.M.Heldt "High Speed Combustion Engines", Oxford-IBH Publishing Co., Calcutta, 1965.

**REFERENCES**

1. A.Kolchin and V.Demidov, "Design of Automotive Engines", MIR Publishers, Moscow, 1984.
2. Sundararaja Murthy T.V "Machine Design", Khanna Publishers, New Delhi, 1991.

**AT 2506 SPECIAL TYPES OF VEHICLES**

**L T P C**  
**3 0 0 3**

**GOAL**

At the end of the course students will be able to know The recent trends in power plants, Noise and pollution control, Vehicle operation and control and Vehicle automated tracks in combat vehicles, earth moving vehicles etc.,

**OBJECTIVES**

The course should enable the students to :

1. Understand the trends in power plants in military and combat vehicles
2. Understand the Suspension brakes and safety of heavy vehicles
3. Conceive the significance of emission control methods in two and three wheelers.

4. Understand the vehicle operation and control of farm vehicles
5. Understand the vehicle automated tracks.

#### **OUTCOME**

The students should be able to :

1. Know about the combat vehicles.
2. Describe the working of stratified charged/lean burn engines.
3. Describe the working of drive line in combat vehicles and earth moving vehicles compared with commercial vehicles.
4. Describe the construction of farm equipments and the working of power trains in heavy vehicles.
5. Able to analyse the ride characteristics of tractors.

#### **UNIT I TRACTORS AND FARM EQUIPMENTS 9**

Classification and power required - Design consideration - Ride and stability characteristics power plants and transmission - Farm equipments.

#### **UNIT II EARTH MOVING MACHINES 9**

Construction and operation aspects of Bull dozers, Scrapers, Dumpers, Loaders, Mobile cranes, Road rollers, Elevators and Elevating graders.

#### **UNIT III MILITARY AND COMBAT VEHICLES 9**

Special requirements like power, fuel strength and impact resistance tanker, Gun carrier and transport vehicle.

#### **UNIT IV CLASSIFICATION AND REQUIREMENTS OF HEAVY VEHICLES 9**

Power plants, chassis and transmission.

#### **UNIT V TWO AND THREE WHEELERS 9**

Constructional details of engine components in moped, scooter, motorcycle and three wheelers.

Magneto ignition systems multiple disc clutch and centrifugal clutch details. Types of gear boxes, types of driver - chain drive, shaft drive, frame and front forks, two wheeler suspension system.

**TOTAL: 45**

#### **TEXT BOOK**

1. Construction planning, Equipment and Methods - Robert L. Peurifoy, William B. Ledbrtter, Clifford J. Schexnayder - McGrawHill, Fifth Edition.

#### **REFERENCES**

1. Motor cycle - M. Michael Griffer
2. A. Gurevich and E.Soreking, Tractors Mir Publishers, Moscow, 1967.
3. V. Rodichev & G. Rodicheva, Tractors and automobiles, MIR Publishers, Moscow.

## AT 2531 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

L T P C  
0 0 3 2

### GOAL

To get the practical knowledge about different automobile electrical and electronic circuits.

### OBJECTIVES

The course should enable the students to :

1. Understand battery testing and maintenance
2. Understand the testing of starting motors and generators.
3. Understand the testing of regulators and cut-outs relay.
4. Understand the diagnosis of ignition system faults.
5. Understand the study of automobile electrical wiring.
6. Understand the study of rectifiers and filters.
7. Understand the study of logic gates, adder and flip-flops.
8. Understand the study of SCR and IC timer.
9. Understand the interfacing of A/D converter.
10. Understand microcontroller programming and interfacing

### OUTCOME

The students should be able to :

1. Describe the testing procedure maintenance of the battery.
2. Conduct high discharge test and specific gravity test in a battery using voltage tester and hydrometer.
3. Describe the working of starter motor.
4. Describe the working of regulators and cut-outs relay.
5. Describe the working of ignition system and to know the diagnosis of ignition system.
6. Describe the various electrical circuits in a vehicle.
7. Construct the rectifier circuit using diodes and to know about the necessity in automobiles.
8. Verify various logic gates truth table by using logic gate kit.
9. Construct SCR and IC timer circuit and verify its characteristics.
10. Get the analog to digital conversion by using microcontroller kit and interface stepper motor to microcontroller kit and control the speed of the stepper motor by using program.

**List of experiments:**

**a. Electrical Laboratory -**

**6 hours each**

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of regulators and cut - outs relay
4. Diagnosis of ignition system faults
5. Study of automobile electrical wiring

**b. Electronics Laboratory -**

**3 hours each**

6. Study of rectifiers and filters
7. Study of logic gates, adder and flip-flops
8. Study of SCR and IC timer
9. Interfacing A/D converter and simple data acquisition
10. Micro controller programming and interfacing

**TOTAL : 45 HOURS**

**List of Equipments - Each 1 No(For a Batch of 30 Students)**

- i. Battery, hydrometer, voltage tester
- ii. Starter motor, regulator, cutout
- iii. Distributor, ignition coil, spark plug
- iv. Auto electrical wiring system
- v. Rectifiers, filters
- vi. Amplifier
- vii. IC timer
- viii. Data logger

## AT 2532 TWO AND THREE WHEELERS LABORATORY

L T P C  
0 0 3 2

### GOALS

The students will be able to understand the constructional details operating characteristics , vehicle design aspects, maintenance and rectifying of faults of Two wheelers and Three Wheelers.

### OBJECTIVES

The subject course enable the students to :

1. Road performance test of a two wheeler using chassis dynamometer.
2. Performance test of a shock absorber.
3. Performance test on coil spring.
4. Understand the slackness of chain.
5. Brake and Clutch adjustment as per specification for 2& 3 Wheelers
6. Dismantling and assembling of 2& 3 wheeler gear box and finding gear ratio.
7. Dismantling and assembling of three wheeler steering system.
8. Study of three wheeler chassis frame and power transmission system.

### OUTCOME

The students should be able to :

1. Analyse the various testing procedure of Two Wheelers using Chassis Dynamometer and measuring the output from dyno.
2. Find the performance of Shock Absorber by using Shock Absorber Test Rig .
3. Find the performance of Coil Spring by using Coil Spring Test Rig
4. Find the slackness of chain and rectifying it by using Tension test elongation apparatus
5. Rectify the fault of Brake and Clutch by using suitable puller and Feeler gauge
6. Know the procedure of using suitable tools to dismantle & assemble of gearbox of 2&3 wheelers and drawing of power flow diagram from Input shaft to output shaft.
7. Know the procedure of using suitable tools to dismantle & assemble Three wheeler steering system and rectifying it.
8. Know about various chassis construction details of Three wheelers and various types power transmission systems from gear box to drive wheels.

### List of Experiments:

1. Road performance test of a two wheeler using chassis dynamometer. (6 Hours)
2. Performance test of a shock absorber. (6 Hours)
3. Performance test on coil spring. (6 Hours)

- |  |           |
|--|-----------|
| 4. Two wheeler chain tension test.   | (6 Hours) |
| 5. Brake and Clutch adjustment as per specification.                             | (6 Hours) |
| 6. Dismantling and assembling of two wheeler gear box and finding gear ratio.    | (3 Hours) |
| 7. Dismantling and assembling of three wheeler gear box and finding gear ratios. | (3 Hours) |
| 8. Three wheeler brake and clutch play adjustment                                | (3 Hours) |
| 9. Dismantling and assembling of three wheeler steering system.                  | (3 Hours) |
| 10. Study of three wheeler chassis frame and power transmission system.          | (3 Hours) |

**TOTAL : 45 HOURS**

**List of Equipments for a Batch of 30 Students**

- a. Two wheeler chassis dynamometer - 1 No.
- b. Shock absorber test rig - 1 No.
- c. Two-wheeler gearbox - 2 Nos.
- d. Two-wheeler clutch - 2 Nos.
- e. Three-wheeler brake assembly - 2 Nos.
- f. Three-wheeler steering assembly - 2 Nos.
- g. Three-wheeler gear box - 2 Nos.

**AT 2533 INTERNSHIP / INDUSTRIAL TRAINING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

Students should undergo Industrial training in reputed Industries for a period of 4 weeks (minimum) during the vacation period at the end of 4thsemester. Examination will be conducted along with the 5thsemester as a practical subjects. Students should prepare a Report and present a seminar for the exam.

**EL 2431 COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**GOAL**

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

**OBJECTIVES**

The course is expected to enable students to:

1. Be aware of self-knowledge by exposure to soft skills, values, behaviour, attitudes, temperamental changes, and a positive attitude to life.

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

### **OUTCOME**

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

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

### **UNIT I**

**20**

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

### **UNIT II**

**20**

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

### **UNIT III**

**20**

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

**UNIT IV****20**

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

**UNIT V****20**

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

**TOTAL : 100**

**Study material will be prepared by the Department of Languages.**

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

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

**Laboratory Requirements:**

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



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

**L T P C**  
**3 0 0 3**

**GOAL**

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

**OBJECTIVE**

The course should enable the students to:

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

**OUTCOME**

The students should be able to:

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

**UNIT I HISTORICAL DEVELOPMENT 9**

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

**UNIT II PLANNING 9**

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

**UNIT III ORGANISING 9**

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

#### UNIT IV DIRECTING

9

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

#### UNIT V CONTROLLING

9

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

**TOTAL: 45**

#### TEXT BOOKS

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

#### REFERENCES

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

### CY 2002 ENVIRONMENTAL SCIENCE AND ENGINEERING

L T P C  
3 0 0 3

#### GOAL

To impart basic knowledge on the significance of environmental science for engineers.

#### OBJECTIVES

The objective of the course is :

1. To make the students aware of the existing natural resources such as forest water resources etc. and to educate them to understand the need for preserving the resources.
2. To educate the students about the functions of various ecosystems and biodiversity.
3. To provide knowledge on the various aspects of different types of pollution such as air pollution, water pollution, soil pollution etc.

4. To give a basic knowledge on the social issues such as global warming, acid rain, ozone layer depletion, nuclear hazards etc. and to educate them about the various Environmental Protection Acts.
5. To create an awareness among the present generation about the various aspects of human population and their effect on environment.

### **OUTCOME**

Upon successful completion of the course, the outcomes are as follows:

1. The students would have understood the effects of over exploitation of water resources, forest resources etc. and their impact on day to day life on earth.
2. Knowledge on the functions of several of ecosystems will help the students to design the processes that are ecofriendly.
3. Knowledge on the different types of pollution will help the young minds to devise effective control measures to reduce rate of pollution.
4. Exposure on the issues such as global warming, acid rain, ozone layer depletion, and nuclear hazards will make the students understand the significances of sustainable development and the need to enforce Environmental Acts.
5. Educating on the various aspects of population explosion will create awareness on population control for effective utilization of the resources and the need to explore new alternate energy resources for a healthy environment.

### **UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10**

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

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

### **UNIT II ECOSYSTEMS AND BIODIVERSITY 14**

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Introduction to Biodiversity - Definition: genetic, species

and ecosystem diversity - 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.

Field study of common plants, insects, birds Field study of simple ecosystems - pond, river, hill slopes, etc.

### **UNIT III ENVIRONMENTAL POLLUTION**

**8**

Definition - Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards - Soil waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster management: floods, earthquake, cyclone and landslides.

Field Study of local polluted site - Urban / Rural / Industrial / Agricultural

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

**7**

From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people; its problems and concerns, case studies - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. - Wasteland reclamation - Consumerism and waste products - Environment Production Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation - Public awareness

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

**6**

Population growth, variation among nations - Population explosion - Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV / AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health - Case studies.

**TOTAL : 45**

### **TEXT BOOKS**

1. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co., 1971.
3. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, 1999.
4. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications, 1998.

## REFERENCES

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India, 2004.
2. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.

## AT 2601 AUTOMOTIVE POLLUTION AND CONTROL

L T P C  
3 0 0 3

### GOAL

To make the students to realize the impact of automobile emissions on the environment and expose student to factors affecting the formation and control of automobile pollutants.

### OBJECTIVES

The course should enable the students to :

- 1 Understand effect of vehicle population and emitted pollutants on human health and environment and various types of emissions.
- 2 Understand the formation mechanism of various types of pollutants from SI and CI engines.
- 3 Conceive the significance of emission control methods.
- 4 Understand the construction and working of emission measuring instruments.
- 5 Be familiar with emission standards and test procedures.

### OUTCOME

The students should be able to :

1. Analyse the impact of vehicle population on pollution and the effects HC, CO, CO<sub>2</sub>, NO<sub>x</sub>, smoke, particulates, lead and aldehydes on health and environment.
2. Describe the effects of transient operation of vehicle on emissions and types of emissions. Describe the formation mechanism of HC, CO, CO<sub>2</sub>, NO<sub>x</sub>, smoke, particulates and aldehydes in SI and CI engines.
3. Comprehend the factors that lead to global warming and the issues. Analyse the design and operating parameters on emissions. Describe about noise pollution, measurement and control.
4. Aware of US, Euro, Japan and Indian emission norms, standards CVS sampling and test procedures. Analyse in-cylinder emission control methods such as EGR, air injection, fuel modifications, water injection, ignition and injection timing.

5. Describe engine-out emission control method such as thermal reactors and catalytic converters. Describe the construction and working of emission measuring instruments such as NDIR, FID, smoke meters Chemiluminiscent analyser and gas chromatograph. Differentiate between two stroke and four stroke engine pollutions.

**UNIT I INTRODUCTION 9**

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution.

**UNIT II POLLUTANT FORMATION IN SI ENGINES 9**

Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NO<sub>x</sub> formation in SI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

**UNIT III POLLUTANT FORMATION IN CI ENGINES 9**

Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions. Nox formation and control. Noise pollution from automobiles, measurement and standards.

**UNIT IV CONTROL OF EMISSIONS FROM SI AND CI ENGINES 9**

Design of engine, optimum selection of operating variables for control of emissions, EGR, Thermal reactors, secondary air injection, DPF, Lean NOX, SCR, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.

**UNIT V MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE 9**

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. Paul Degobert -Automobiles and Pollution - SAE International ISBN-1-56091-563-3, 1991.
2. Ganesan, V- "Internal Combustion Engines"- Tata McGraw-Hill Co.- 2003.

**REFERENCES**

1. SAE Transactions- "Vehicle Emission"- 1982 (3 volumes).
2. Obert.E.F.- "Internal Combustion Engines"- 1988
3. Marco Nute- " Emissions from two stroke engines, SAE Publication - 1998.

## AT 2602 VEHICLE DYNAMICS

L T P C  
3 1 0 4

### GOAL

To impart knowledge in Dynamic characteristics of vehicles.

### OBJECTIVES

The course enables the students to:

1. Enhance the knowledge in vibration of vehicles due to dynamic conditions.
2. Grasp the importance of the comfort and safe riding characteristics.
3. Understand the vehicle performance parameters and various testing methodologies.
4. Understand the effects ride characteristics over the stability of vehicles.
5. Determine fundamental frequency for coupled system.

### OUTCOME

The students should be able to:

1. Perceive the significance of Vibration analysis.
2. Analyze the reactions of each wheels subjected to various loads. And the stability of the vehicles for various road conditions.
3. Calculate tractive effort and reactions for different drives and solve problems based on vehicle handling characteristics
4. Acquire knowledge over the influence of performance parameters on ride characteristics.
5. Apply Dunkerley's and Rayleigh's methods for determining fundamental frequency.

### UNIT I INTRODUCTION

12

Single degree of freedom, two degree of freedom, free, forced and damped vibrations modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.

### UNIT II MULTI DEGREE FREEDOM SYSTEMS

12

Closed and coupled far system, orthogonality of mode shapes, modal analysis.

### UNIT III STABILITY OF VEHICLES

12

Load distribution, stability on a curved track slope and a banked road, calculation of tractive effort and reactions for different drives.

### UNIT IV SUSPENSION TYRES AND VEHICLES HANDLING

12

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of side forces, tyre, dynamics, ride characteristics power consumed by a tyre. Over-steer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

## UNIT V NUMERICAL METHODS

12

Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched system.

**TOTAL : 60**

### TEXT BOOKS

1. Giri N.K - Automotive Mechanics, Khanna Publishers, 2002.
2. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., New Delhi -2, 2002.

### REFERENCES

1. Heldt.P.M -"Automotive Chassis"- Chilton Co., New York- 1992
2. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
3. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998
4. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
5. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.

## AT 2603 AUTOMOTIVE CHASSIS DESIGN

L T P C  
3 1 0 4

### GOAL

To Provide The Students With Knowledge To Understand The Fundamental Principles Involved In Design Of The Components Of Automotive Chassis

### OBJECTIVES

The course should enable the student to

1. Learn design calculation of various types of clutches.
2. Understand the performance of vehicles and design of gear box.
3. Study various loads, moments and stresses on frame members and suspensions..
4. Learn the details about front axle and steering systems.
5. Understand the design of final drive and rear axle.

### OUTCOME

Upon completion , the student should be able to

1. Apply the knowledge gained through various design of clutches for modifications.
2. Deal with the performance of vehicles and design of gear box..
3. Be familiar with various types of loads, stresses acting on frame and suspension of vehicles..



4. Be familiar with design of front axle and steering systems.
5. Deal with design of final drive and rear axle.

**UNIT I CLUTCH DESIGN CALCULATION 12**

Design of single plate clutch, multi plate clutch, design of centrifugal clutch, cone clutch, energy dissipated, torque capacity of clutch, design of clutch components, design details of roller and sprag type of clutches

**UNIT II GEAR BOX 12**

Performance of vehicle, total resistance to motion, traction and tractive effort, acceleration, calculation of gear ratio, design of three speed gear box, design of four speed gear boxes.

**UNIT III VEHICLE FRAME AND SUSPENSION 12**

Study of loads, moments and stresses on frame members, computer aided design of frame for passenger and commercial vehicles, computer aided design of leaf springs, coil springs and torsion bar springs.

**UNIT IV FRONT AXLE AND STEERING SYSTEMS 12**

Analysis of loads, moments and stresses at different sections of front axle, determination of loads at kingpin bearings, wheel spindle bearings, choice of bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

**UNIT V FINAL DRIVE AND REAR AXLE 12**

Design of propeller shaft, design details of final drive gearing, design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings.

**TOTAL: 60**

**TEXT BOOKS**

1. Giri.N.K- "Automobile Mechanics"- Khanna Publisher, New Delhi- 2002
2. Heldt.P.M - "Automotive Chassis"- Chilton Co., New York- 1992

**REFERENCES**

1. Steeds. W -"Mechanics of Road Vehicles"- Illiffe Books Ltd., London- 1990
2. Giles.K.G - Steering, Suspension and tyres"- Illiffe Books Ltd., London - 1988
3. Newton Steeds & Garret- "Motor Vehicle"- Illiffe Books Ltd., London - 2000
4. Heldt.P.M- "Torque converter" - Chilton Book Co., New York - 1982
5. Dean Averns - "Automobile Chassis Design"- Illiffe Books Ltd - 1992

## AT 2604 AUTOMOTIVE SAFETY

L T P C  
3 0 0 3

### GOAL

The student will be able to know about the various safety aspects and safety components in the vehicle for the safety of the driver, passengers and the pedestrians.

### OBJECTIVES

The course should enable the students to:

1. Know about the basics about the vehicle.
2. Understand the safety aspects in the vehicle.
3. Know and understand the various safety aspects.
4. To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle.
5. To know about the comfort and convenience system.

### OUTCOME

The students should be able to :

1. Know about the design of the bumper for safety.
2. Know about the concept of crumble zone, and also the effect of acceleration and deceleration of the vehicle in the compartment of the vehicle.
3. Know the various types of safety aspects such as active and passive safety, the active safety components and the working passive safety components such as air bags, seat belts
4. Know the working of the compartment while moving of the vehicle, about the collapsible steering and tiltable steering column, about the collision avoidance system, front and rear object detection.
5. know about the rear vehicle detection system, and the braking system, the comfort and convenience system for the vehicle such as central locking system, garage door opening system and about the environment information 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 safety- passive 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.

**AT2631 COMPUTER AIDED ENGINE AND CHASSIS DESIGN LABORATORY**

**L T P C**  
**0 0 3 2**

**GOAL**

To make the students to understand the design and calculations of gear box assembly, clutch assembly and bearing loads by using various drafting software like Pro-E, Catia etc.

**OBJECTIVES**

The course should enable the students to :

1. Understand the gear box assembly calculations by using drafting software like Catia.
2. Draw and calculate the clutch components assembly by using drafting software like Catia.
3. Design and analysis the selection of bearing and calculation of bearing loads by using drafting software.
4. Know about the design of engine component piston.
5. Know about the design of engine component piston pin and piston ring.
6. Know about the design of engine component connecting rod and its components.
7. Know about the design of connecting rod.

8. Know about the design of flywheel.
9. Know about the design of inlet and exhaust valve.
10. Know about the design of cam, camshaft and the design of engine cylinder and cylinder block.

### **OUTCOME**

The students should be able to :

1. Complete design of clutch components and Assembly drawing of clutch using drafting software.
2. Gear train calculations. Layout of gear box.
3. Calculate of bearing loads, Selection of bearings and Assembly drawing of gear box using drafting software.
4. Design and draw the piston, piston pin and piston rings as per the engine specification.
5. Design and draw the crank shaft components such as small end, big end, shank design, design of big end cap and bolt as per the engine specification.
6. Design and draw the crankshaft and the balancing weight as per the engine specification.
7. Design and draw the flywheel as per the engine specification.
8. Design and draw the IC engine valve for both inlet and exhaust as per the engine specification.
9. Design and draw the cam, cam shaft as per the engine specification.
10. Design the cylinder and cylinder block dimensions as per the engine specification.

### **LIST OF EXPERIMENTS**

1. Design and drawing of piston, piston pin and piston rings and drawing of these components. (6 Hours)
2. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly (6 Hours)
3. Design of crankshaft. (6 Hours)
4. Design and drawing of flywheel. Design and drawing of the inlet and exhaust valves. (6 Hours)
5. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft. (6 Hours)
6. Complete design of clutch components. (3 Hours)
7. Assembly drawing of clutch using drafting software. (3 Hours)
8. Gear train calculations. (3 Hours)

- |     |   |           |
|-----|---|-----------|
| 9.  | Selection of bearings.                                | (3 Hours) |
| 10. | Assembly drawing of gear box using drafting software. | (3 Hours) |

**TOTAL : 45 HOURS**

**The List of Equipments For a Batch of 30 Students**

- |    |                              |               |
|----|------------------------------|---------------|
| 1. | Computer nodes               | - 30 Nos.     |
| 2. | Software like Pro-E or CATIA | - 30 licenses |

**AT 2632 VEHICLE DYNAMICS LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**GOALS**

The students will be able to understand the basics of vibration characteristics of the mechanical and Automotive components as well as to know about Mathematical software and MBS software..

**OBJECTIVES**

The course should enable the student to :

1. Testing of natural frequency.
2. Measurement of displacement velocity and acceleration.
3. Whirling of Shafts.
4. Critical Speed Determination.
5. Measurement of Front Wheel Geometry.
6. Introduction to MATLAB- SIMULINK solving simple MCK problems
7. Conversion of Analog to Digital and Digital to Analog
8. Study of LS Dyna / Adams

**OUTCOME**

The students should be able to :

1. To find the natural frequency of the given material
2. Using various sensors to find displacement, Velocity and acceleration with the use of Mathematical software.
3. Using circular rod to find its maximum permissible location of bending while it is getting rotated.
4. Using circular rod to find its maximum permissible location of bending while it is getting rotated from its axis shift from original axis.

5. Using wheel alignment equipments to find a front wheel geometry of Toe in/out, Caster, Camber/ King Pin Inclination and Included angle.
6. Using MATLAB- SIMULINK software to solve simple mechanical systems.
7. Using data card to find D/A to A/D convertor
8. Using Multi Body dynamics software to solve simple Car model.

**List of experiments:**

- |     |  |           |
|-----|--|-----------|
| 1 . | Testing of natural frequency                                 | (6 Hours) |
| 2.  | Measurement of displacement velocity and acceleration        | (6 Hours) |
| 3.  | Whirling of Shafts   | (6 Hours) |
| 4.  | Critical Speed Determination                                 | (6 Hours) |
| 5.  | Measurement of Front wheel geometry                          | (6 Hours) |
| 6.  | Introduction to MATLAB-SIMULINK, solving simple MCK problems | (6 Hours) |
| 7.  | Conversion of Analog to Digital and Digital to Analog        | (6 Hours) |
| 8.  | Study of LS Dyna / Adams                                     | (3 Hours) |

**TOTAL : 45 HOURS**

**The List of Equipments for a Batch of 30 Students**

- |    |   |            |
|----|---|------------|
| 1. | Four Wheeler Chassis Dynamometer                            | - 1 No.    |
| 2. | Shock absorber test rig                                     | - 1 No.    |
| 3. | Measuring Devices - Displacement, Velocity and acceleration | - 1 No.    |
| 4. | Piston and Valves   | - 5 Nos.   |
| 5. | A/ D Converter  | - 1 Nos.   |
| 6. | D / A Converter   | - 1 No.    |
| 7. | MAT Lab Software  | - 30 Users |
| 8. | Adams / L.S. Dyna   | - 30 Users |

## AT 2633 FUELS AND LUBRICANTS LABORATORY

L T P C  
0 0 3 2

### GOAL

To provide the students with the ability to investigate the fuels and lubricants property to enhance his / her independent practical abilities.

### OBJECTIVES

The course should enable the students to :

1. Do independent experiments to find out the properties of fuels and lubricants.
2. Grasp the importance of fuels and lubricants.
3. Do the experiments with different constrains.
4. Be familiar with the properties of fuels and lubricants.

### OUTCOME

The students should be able to :

1. Produce high focused independent practical skill on fuels and lubricants.
2. Identify how they can be involved in doing experiments.
3. Perform an in-depth analysis related with any fuel / lubricant.
4. Describe how the temperature and friction can influence the properties of fuels and lubricants.

### LIST OF EXPERIMENTS

1. Temperature dependence of viscosity of lubrication oil by Redwood viscometer.(3 hours)
2. Viscosity index of lubricating oil by Say bolt viscometer (3 hours)
3. Flash and fire points of fuels. (3 hours)
4. Flash and fire points of lubricants. (3 hours)
5. ASTM distillation test of gasoline (3 hours)
6. Drop point of grease (3 hours)
7. Mechanical penetration in grease. (3 hours)
8. Aniline distillation test of gasoline (6 hours)
9. Reid vapor pressure test. (6 hours)
10. Study of Bomb Calorimeter. (6 hours)
11. Study of Gas Calorimeter. (6 hours)

**TOTAL : 45 HOURS**

**List of Equipments ----- Each 1 No(For A Batch Of 30 Students)**

1. Redwood Viscometer
2. Say bolt Viscometer
3. Flash and Fire point apparatus
4. ASTM distillation test apparatus
5. Mechanical penetration apparatus for grease
6. Aniline distillation test apparatus
7. Reid vapor pressure test apparatus
8. Drop point of grease apparatus
9. Bomb Calorimeter
10. Gas Calorimeter



**SEMESTER-VII**  
**MG 2002 TOTAL QUALITY MANAGEMENT**

**L T P C**  
**3 0 0 3**

**GOAL**

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

**OBJECTIVES**

The course will enable the students:

1. To understand the Total Quality Management concepts and principles and the various tools available to achieve Total Quality Management in an organizational setting
2. Explain the importance of Statistical Process Control (SPC), methods in testing and measuring quality acceptance, quality standards for product and services in an organization using seven management tools.
3. To explain the statistical approach for quality control.
4. To create an awareness about the ISO and QS certification process and its need in an organization.

**OUTCOME**

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

1. Appreciate quality and understands various dimensions of quality, aspects that are related to quality cost, and methods to implement quality in an organization.
2. Have a clear understanding of customer perception and the need for ensuring quality of products or services and ways to attain customer satisfaction.
3. Explain the importance of Statistical Process Control (SPC), methods in testing and measuring quality acceptance, quality standards for product and services in an organization using seven management tools.
4. Clearly understand the various ISO standards and procedures involved in assuring and ensuring quality.

**UNIT I INTRODUCTION**

**9**

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

**UNIT II TQM PRINCIPLES**

**9**

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

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

**UNIT III STATISTICAL PROCESS CONTROL (SPC) 9**

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

**UNIT IV TQM TOOLS 9**

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

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System - Elements, Implementation of Quality System, Documentation,Quality Auditing,TS 16949,ISO14000- Concept, Requirements and Benefits.

**TOTAL: 45**

**TEXT BOOK**

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

**REFERENCES**

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

## AT 2701 VEHICLE BODY ENGINEERING

L T P C  
3 0 0 3

### GOAL

To provide the students sound knowledge of the design of the vehicles body for the maximum comfort

### OBJECTIVES

The course should enable the student to:

1. Study different types of car and its constructions.
2. Understand the aerodynamics involved in vehicles.
3. Gain knowledge regarding various types of bus and its construction details.
4. Learn the details available in various commercial vehicles.
5. Study the properties of body materials and its corresponding mechanism.

### OUTCOME

Upon completion , the student should be able to:

1. Be acquainted with knowledge of different types of cars.
2. Analyse the aerodynamics involved in vehicles.
3. Be familiar with various types of bus and construction details.
4. Be familiar with various types of commercial vehicles..
5. Analyse the properties of body materials and its 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 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.

**AT 2702 VEHICLE MAINTENANCE**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**GOAL**

Provide maximum availability of safe and serviceable vehicles and maximum economic service life of vehicles.

**OBJECTIVES**

The subject should enable the student to:

1. Understand the complete knowledge of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail.
2. Understand various types of maintenance of vehicles and features and applications.
3. Objective of the preventive maintenance program is to minimize breakdowns, unscheduled repairs, and undue wear and tear.
4. To ensure maximum vehicle availability for customers with minimum interruptions due to unscheduled repairs and breakdowns.
5. To Minimize the consumption of petroleum based fuels and assure fuel security and accountability;
6. To Minimize the cost of fuel used by the fleet and provide safe, convenient fueling access for fleet customers.

## OUTCOME

The students should be able to:

1. Differentiate various layouts, analyze the merits and limitations and apply in real time.
2. Dismantle study, perform corrections and assemble the various parts of the vehicle.
3. Describe the maintenance procedures of various systems like steering systems, braking system, suspension system and engine etc.
4. Dismantle study, rectify and assemble drive line system, final drive and differential, rear axle, wheels and tires, suspension and brake systems.
5. Realize effects of maintenance and minimize the consumption of petroleum based fuels. Describe the maintenance procedures of various electrical systems like battery, starter motor, alternator, D.C motor etc.
6. Be familiar with maintenance procedures of engine, cooling system and lubrication system, checking and servicing of dash board instruments. Be familiar with wheel alignment, computerized alignment and wheel balancing, and door locks and window glass actuating system maintenance.

### **UNIT I MAINTENANCE OF RECORDS AND SCHEDULES 9**

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, Maintenance of records, log sheets and other forms, safety precautions in maintenance.

### **UNIT II ENGINE MAINTENANCE - REPAIR AND OVERHAULING 9**

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

### **UNIT III CHASSIS MAINTENANCE - REPAIR AND OVERHAULING 9**

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

### **UNIT IV ELECTRICAL SYSTEM MAINTENANCE - SERVICING AND REPAIRS 9**

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

### **UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY 9**

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion

and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, Minor and major repairs. Door locks and window glass actuating system maintenance.

**TOTAL: 45**

**TEXT BOOK**

1. John Doke "Fleet Management", McGraw-Hill Co. 1984.

**REFERENCE**

1. James D Halderman - Advanced Engine Performance Diagnosis - PHI - 1998. Service Manuals from Different Vehicle Manufacturers.

**AT 2703 AUTOMOTIVE INSTRUMENTATION AND EMBEDDED SYSTEM**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**GOAL**

To make the students to understand the instruments involved in measurement of various automotive parameters and a basic knowledge on embedded systems.

**OBJECTIVES**

The course should enable the student to:

1. Understand measurement characteristics.
2. Understand the working of automotive instruments.
3. Know about the measurement analysis.
4. Understand the working of embedded systems.
5. Understand the working of real time operating system(RTOS)

**OUTCOME**

The students should be able to:

1. Describe the classification of instrument and characteristics of instruments and the static and dynamic analysis, experimental error analysis, and statistical analysis.
2. Describe the working of modern automotive instrumentation and computerized instrumentation system.
3. Describe the measurements of fuel quantity, coolant temperature, oil pressure, vehicle speed and the working of display devices and information system and the operation of onboard and off board diagnostics , occupant protection system and warning system
4. Describe the working of gas analyzers, smoke tester, gas chromatography and spectrometry and the measurement of pH and review of basic measurement techniques.

- Describe the working of serial communication using i2c,CAN,USB buses and parallel communication using ISA,PCI and the basics of basic concepts of RTOS, basics of real time and embedded system operating systems.

**UNIT I MEASUREMENT CHARACTERSTICS 9**

Instrument Classification, Characteristics of Instruments - Static and dynamic, experimental error analysis, Systematic and random errors, Statistical analysis, Uncertainty, Experimental planning and selection of measuring instruments, Reliability of instruments.

**UNIT II AUTOMOTIVE INSTRUMENTATION 9**

Modern automotive instrumentation - computerized instrumentation system, multiplexing, sampling and advantages - Measurements - fuel quality, coolant temperature, oil pressure vehicles speed, Display devices - LED, LCD, VFD, CRT and types, CAN network, the glass cockpit and information system.

Onboard diagnostics - fault code displays. Off board diagnostics - engine data display, expert system occupant protection system - Airbag deployment system security and warning systems.

**UNIT III MEASUREMENT ANALYSIS 9**

Chemical, thermal, magnetic and optical gas analyzers, measurement of smoke, dust and moisture, gas chromatography, spectrometry, measurement of pH, Review of basic measurement techniques.

**UNIT IV INTRODUCTION TO EMBEDDED SYSTEM 9**

Introduction to functional building blocks of embedded systems - Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories -Devices & buses for devices network - serial communication using I2C, CAN, USB buses - parallel communication using ISA, PCI - device drivers in a system - Serial port & parallel port.

**UNIT V REAL TIME OPERATING SYSTEM (RTOS) 9**

Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS - Interrupt handling, task scheduling; embedded system design issues in system development process - Action plan, use of target system, emulator, use of software tools.

**TOTAL : 45**

**TEXT BOOKS**

- William B.Riddens - Understanding Automotive Electronics, 5th edition- Butter worthHeinemann, Woburn- 1998
- Rajkamal, 'Embedded System - Architecture, Programming, Design', Tata McGraw Hill,2003.
- Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2004.
- Holman, J.P., Experimental methods for engineers, McGraw-Hill, 1988
- Raman, C.S., Sharma, G.R., Mani, V.S.V., Instrumentation Devices and Systems, TataMcGraw Hill, New Delhi, 1983.

## AT 2704 MANUFACTURING PROCESS OF AUTOMOTIVE COMPONENTS

L T P C  
3 0 0 3

### GOAL

To make the students to realize and understand various manufacturing processes like forming, milling, casting and moulding involved in production of automotive components.

### OBJECTIVES

The course should enable the student to:

1. Understand the powder metallurgy manufacturing process.
2. Understand the forming process in which various automotive components , manufacturing process
3. Understand the casting & machining process in which various automotive components manufacturing process
4. Understand the various gear manufacturing process
5. Understand recent trends in automotive manufacturing process

### OUTCOME

The students should be able to :

1. Process flow chart , Production of metal powders and Manufacturing of friction lining materials for clutches and brakes as well as Testing and inspection of PM parts.
2. Various Forging process of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Various extrusion process of manufacturing transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Various Hydro forming Process of manifold, tail Lamp housing, auto body panels
3. Various casting process of cylinder block, liners, flywheel, piston rings, bearing bushes and liners, piston, carburetor and other small auto parts. Various Machining process of connecting rods, crank shafts, cam shafts, pistons, piston pins, piston rings, valves, front and rear axle housings, flywheel, Honing of cylinder bores, copy turning and profile grinding machines.
4. Various Gear Manufacturing process like milling, Hobbing and shaping, Gear finishing and inspection process.
5. Various process like Powder injection moulding - Shot peen hardening , Production of aluminum MMC, Plasma spray coating, Squeeze casting, aluminum composites.

### UNIT I POWDER METALLURGY

5

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

12

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. Hydro forming: Process, hydro forming 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 CASTING AND MACHINING**

**12**

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes and liners, permanent mould casting of piston, pressure die casting of carburetor and other small auto parts.

Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - flywheel - Honing of cylinder bores - copy turning and profile grinding machines.

### **UNIT IV GEAR MANUFACTURING**

**8**

Gear milling, Hobbing and shaping - Gear finishing and inspection.

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

**8**

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

**TOTAL: 45**

### **TEXT BOOKS**

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, Taraporevla Son & co Pvt Ltd, Mumbai, 1995.
3. Sabroff.A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, NewYork, 1988.
4. Upton, Pressure Die Casting, Pergamon Press, 1985.
5. High Velocity Forming of metals, ASTM, Prentice Hall of India (P) Ltd., New Delhi, 1990.

## AT 2731 SOFTWARE APPLICATIONS LABORATORY

L T P C  
0 0 3 2

### GOAL

To impart knowledge about the modeling of various Automotive Engine components & the various analysis of the same with the relevant modeling & analysis software.

### OBJECTIVES

The subject should enable the student to model & analyze various engine components, according to the specifications, such as

1. Piston.
2. Piston pin & rings.
3. Connecting Rod.
4. Inlet & Exhaust valves.
5. Crankshaft.
6. Balancing weight of Crankshaft.
7. Camshaft.

### OUTCOME

The students should be able to model the various engine components, for the given specifications & to analyze the same for various load & temperature conditions, such as

1. Piston.
2. Piston pin & rings.
3. Connecting Rod.
4. Inlet & Exhaust valves.
5. Crankshaft.
6. Balancing weight of Crankshaft.
7. Camshaft

### List of Experiments

Modeling and Analysis of following IC Engine Parts

- |                                |           |
|--------------------------------|-----------|
| 1. Piston                      | (6 hours) |
| 2. Piston Pin and Piston Rings | (6 hours) |
| 3. Connecting Rod              | (6 hours) |
| 4. Inlet and Exhaust Valves    | (6 hours) |
| 5. Crankshaft                  | (6 hours) |

- |    |                                |           |
|----|--------------------------------|-----------|
| 6. | Balancing weight of Crankshaft | (6 hours) |
| 7. | Camshaft                       | (9 hours) |

**TOTAL : 45 HOURS**

**List of Equipments (for a batch of 30 students)**

- |    |                                      |           |
|----|--------------------------------------|-----------|
| 1. | Computer                             | - 30 Nos. |
| 2. | Software like Pro/E, CATIA and ANSYS | - 30 Nos. |

**AT 2732 VEHICLE MAINTENANCE & RECONDITIONING LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**GOAL**

Provide maximum availability of safe and serviceable vehicles and maximum economic service life of vehicles.

**OBJECTIVES**

The course should enable the student to :

1. Understand the complete knowledge of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail.
2. Understand various types of maintenance of vehicles and features and applications.
3. Objective of the preventive maintenance program is to minimize breakdowns, unscheduled repairs, and undue wear and tear.
4. To ensure maximum vehicle availability for customers with minimum interruptions due to unscheduled repairs and breakdowns.
5. To Minimize the cost of fuel used by the fleet and provide safe, convenient fuelling access for fleet customers.

**OUTCOME**

The students should be able to :

1. Describe the minor and major tuning of diesel and petrol engines
2. Dismantle, study, perform corrections and assemble the braking system, steering system and suspension system.
3. Adjust the pedal play in clutch brake, hand brake and steering wheel.
4. Do the wheel alignment procedure and tyre removal procedure etc.
5. define the procedures of valve grinding, lapping, reboring calibration of fuel injection pump etc.

### List of experiments

#### VEHICLE MAINTENANCE LABORATORY

30 Hours

1. Study and layout of automobile repair shop.
2. Study and preparation of workshop statements.
3. Study and list of tools and instruments.
4. Minor and major tuning of diesel and petrol engines.
5. Fault diagnosis of ignition, starting and charging system.
6. Fault diagnosis of petrol and diesel fuel system and filters & air cleaners.
7. Fault diagnosis of lighting system horn & wiper.
8. Performing body repair works.
9. Adjustment of pedal play in clutch brake, hand brake and steering wheel.
10. Bleeding of hydraulic brake system and diesel fuel system and wheel bearing adjustment.
11. Removal of tyre & tube and adjustment of head lights.

#### RE-CONDITIONING LABORATORY

15 Hours

1. Cylinder reboring - checking the cylinder bore.
2. Valve grinding, valve lapping.
3. Setting the valve angle and checking for valve leakage
4. Calibration of fuel injection pump
5. Wheel alignment - testing of camber, caster.
6. Testing kingpin inclination, toe-in and toe-out.
7. Brake adjustment
8. Brake bleeding.

**TOTAL : 45 HOURS**

#### LIST OF EQUIPMENTS FOR VEHICLE MAINTENANCE (for a batch of 30 students) Each 1No

1. Engine Analyzer
2. Cylinder compression pressure gauge
3. Vacuum gauge
4. Spark plug cleaner and tester
5. Cam angle and rpm tester
6. Tachometer
7. Wheel alignment apparatus

8. Gas welding equipment
9. Tyre remover
10. Bearing puller
11. Head light alignment gauge
12. Service manuals of petrol, diesel engines

**LIST OF EQUIPMENTS FOR RECONDITIONING (for a batch of 30 students) Each 1 No**

1. Cylinder reboring machine
2. Valve grinding machine
3. Valve lapping machine
4. Fuel injection calibration test bench with nozzle tester
5. Wheel alignment apparatus.

**SEMESTER VIII**  
**AT 2801 MODERN VEHICLE TECHNOLOGY**

**L T P C**  
**3 0 0 3**

**GOAL**

At the end of the course students will be able to know The recent trends in power plants, Noise and pollution control in automobiles, Vehicle operation and control and Vehicle automated tracks.

**OBJECTIVES**

The course should enable the student to:

- 1 Understand the trends in power plants
- 2 Understand the Suspension brakes and safety.
- 3 Conceive the significance of emission control methods.
4. Understand the vehicle operation and control
- 5 Understand the vehicle automated tracks.

**OUTCOME**

The students should be able to:

- 1 Know about the hybrid vehicles , battery vehicles and magnetic track vehicles.
- 2 Describe the working of stratified charged/lean burn engines and hydrogen engines and the working of air suspension and closed loop suspension system.
- 3 Describe the working of antiskid braking system, regenerative braking safety cage and passenger comfort system and the internal and external pollution control through alternate fuels and power plants
4. Describe the working of catalytic converters and particulate filters, about noise pollution, measurement and control, the computer control for pollution and noise control for fuel economy and the working of transducers, actuators and information technology for receiving proper information and operation of the vehicle like optimum speed and direction.
- 5 Describe the preparation and maintenance of proper road network and national highway network with automated roads and vehicles and the working of vehicle operation for safe and fast travel by using satellite.

**UNIT I TRENDS IN POWER PLANTS**

**9**

Hybrid vehicles - stratified charged / lean burn engines - Hydrogen engines - batteryvehicles - Electric propulsion with cables - magnetic track vehicles.

**UNIT II SUSPENSION BRAKES AND SAFETY**

**9**

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

**UNIT III NOISE & POLLUTION****9**

Reduction of noise - Internal & external pollution control through alternate fuels / powerplants - Catalytic converters and filters for particulate emission.

**UNIT IV VEHICLE OPERATION AND CONTROL****9**

Computer control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

**UNIT V VEHICLE AUTOMATED TRACKS****9**

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel.

**TOTAL: 45****TEXT BOOK**

1. Heinz Heisler, "Advanced Vehicle Technology" - Arnold Publication.

**REFERENCES**

1. Beranek.L.L., Noise reduction, McGraw Hill Book Co., Inc., Newyork, 1993.
2. Bosch Hand Book, 3rd Edition, SAE, 1993.

**AT 2831 PROJECT & VIVA VOCE****L T P C  
0 0 24 6****OJECTIVE**

The objective of the project work is to enable the students in convenient groups of not more than 3 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading , laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

The assessment will be done on a continuous basis as follows :

<b>Review / Exam</b>	<b>Weightage</b>
First Review	10%
Second Review	20%
Third Review	20%
Final Viva Voce	50%
<b>Total</b>	<b>100%</b>

### **Elective Syllabus for VII Semester**

#### **ME 2755 QUALITY CONTROL & RELIABILITY ENGINEERING**

**L T P C**  
**3 0 0 3**

#### **GOAL**

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

#### **OBJECTIVES**

The course should enable the students to:

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

#### **OUTCOME**

The students should be able to:

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

#### **UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES**

**10**

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process-factors-process capability-process capability studies and simple problems-Theory of control chart-uses of control chart- Control chart for variables.

#### **UNIT II PROCESS CONTROL FOR ATTRIBUTES**

**8**

Control chart for attributes - control chart for proportion or fraction defectives - p chart and np chart-



control chart for defects - C and U charts, State of control and process out of control identification in charts.

**UNIT III ACCEPTANCE SAMPLING**

**9**

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

**UNIT IV LIFE TESTING - RELIABILITY**

**9**

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

**UNIT V QUALITYAND RELIABILITY**

**9**

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

**TOTAL: 45**

**TEXT BOOKS**

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

**REFERENCES**

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

## ME 2757 COMPUTATIONAL FLUID DYNAMICS

L T P C  
3 0 0 3

### GOAL

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

### OBJECTIVES

The course should enable the students to:

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

### OUTCOME

The students should be able to:

1. Know the equations governing fluid flow and heat transfer.
2. Appreciate the tools available for solving the algebraic equations.
3. Appreciate the problems associated with discretisation of incompressible flow
4. Solve the practical problems associated with Fluid Flow and Heat Transfer using commercial software.

### UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS

9

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

### UNIT II DISCRETISATION AND SOLUTION METHODOLOGIES

9

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

### UNIT III HEAT CONDUCTION

9

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

#### UNIT IV CONVECTION AND DIFFUSION

9

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

#### UNIT V CALCULATION OF FLOWFIELD

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 ( $k-\epsilon$ ) 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 Indian Edition. 2009.
2. Muralidhar, K and Sundarajan, T., Computational Fluid Flow and Heat Transfer, Narosa Publishing House, New Delhi, 2nd Edition 2008.
3. Bose, T.K., Numerical Fluid Dynamics, Narosa publishing House, 1997.
4. Muralidhar, K and Biswas Advanced Engineering Fluid Mechanics, Narosa Publishing House, New Delhi, 2nd Edition, 2006.
5. Anderson, J.D., Computational fluid dynamics - the basics with applications, 1995.

#### AT 2751 COMPOSITE MATERIALS & STRUCTURES

L T P C  
3 0 0 3

#### GOALS

To impart the knowledge about the composite materials and to aware of their importance for using as a alternative materials for automotive components

#### OBJECTIVES

The subject should enable the student to:

1. Understand the different types of composite materials, their properties and applications.
2. Understand Polymer matrix composites
3. Understand Metal matrix composites

4. Understand Ceramic matrix Composites
5. Understand Advances in composites

### **OUTCOME**

The students should be able to :

1. Define the properties, classification and applications of composites in the Industries. Composite materials over conventional materials.
2. Understand Polymer matrix composites
3. Understand Metalmatrix composites
4. Understand Ceramic matrix Composites
5. Understand Advances in composites

### **UNIT I INTRODUCTION TO COMPOSITES 9**

Fundamentals of composites - need for composites - Enhancement of properties - classification of composites - Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) - Reinforcement - Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

### **UNIT II POLYMER MATRIX COMPOSITES 9**

Polymer matrix resins - Thermosetting resins, thermoplastic resins - Reinforcement fibres - Rovings- Woven fabrics-Non woven random mats-various types of fibres. PMC processes - Hand layup processes - Spray up processes - Compression moulding - Reinforced reaction injection moulding-Resintransfer moulding- Pultrusion-Filament winding-Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GFRP).

### **UNIT III METALMATRIX COMPOSITES 9**

Characteristics of MMC, Various types of Metal matrix composites Alloyvs.MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements-particles-fibres. Effect of reinforcement -Volume fraction-Rule of mixtures. Processing of MMC-Powder metallurgy process-diffusion bonding - stir casting - squeeze casting.

### **UNIT IV CERAMIC MATRIX COMPOSITES 9**

Engineering ceramic materials - properties - advantages - limitations - Monolithic ceramics -Need for CMC - Ceramic matrix-Variety types of Ceramic Matrix composites - oxideceramics- non oxide ceramics - aluminium oxide- silicon nitride- reinforcements-particles-fibres-whiskers. Sintering - Hot pressing - Cold isostatic pressing (CIPing) - Hot isostatic pressing (HIPing).

### **UNIT V ADVANCES IN COMPOSITES 9**

Carbon/ carbon composites-Advantages of carbon matrix-limitations of carbon matrix Carbon fibre-chemical vapour deposition of carbon on carbon fibre perform.Solgel technique. Composites for aerospace applications.

**TOTAL: 45**

### TEXT BOOKS

1. Mathews F.L. and Rawlings R.D., "Compositematerials:Engineering and Science", Chapman and Hall, London, England, 1st edition, 2005.
2. Chawla K.K., "Composite materials", Springer - Verlag, 2nd Edition , 2009.

### REFERENCES

1. Clyne T. W. and Withers P.J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
2. Strong A.B., "Fundamentals of Composite Manufacturing", SME, 1989.
3. Sharma S.C., "Composite materials", Narosa Publications, 2000.
4. "Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy", IIT- Madras, December 2001.

### AT 2752 FINITE ELEMENT METHODS IN AUTOMOBILES

L	T	P	C
3	0	0	3

### GOAL

To understand the principles involved in discretization and finite element approach and to learn to form stiffness matrices and force vectors for simple elements.

### OBJECTIVES

The subject should enable the students to:

1. Understand the basics of Engineering problems, Mathematical modeling of FEA
2. Understand the finite element formulations of Boundary Value problems.

### OUTCOME

The students should be able :

1. To know the various engineering problems, formulate mathematical modeling and know engineering applications of FEA..To know about various methods like Weighted residual methods, General weighted residual statement, Weak formulation of the weighted residual for formulations of Boundary Value Problem
2. To know about statement, Comparisons, Piecewise continuous trial functions like a bar finite element.To know functional and differential forms of Principle of stationary total potential , Rayleigh Ritz method , Piecewise continuous trial functions To know finite element method and Choice of the elements
3. To know general form of total potential for 1-D applications , Generic form of finite element equations To know various bar elements like Linear element, Quadratic element, To know Nodal approximation, Development of shape functions To know to solve Truss and Beam element problems.

4. To know approximation of geometry and field variable of 3 noded triangular elements, Four noded rectangular elements, Higher order elements .To know Generalized coordinates approach to nodal approximations, Difficulties To know Natural coordinates and coordinate transformations To know triangular and quadrilateral elements and Iso-parametric elements
- 5 To know Structural mechanics applications in 2-dimensions - Elasticity equations, Stress strain relations , Plane problems of elasticity, Element equations - , Assembly.To know need for quadrature formulae, Transformations to natural coordinates To know Gaussian quadrature and solving problems in plane stress, plane strain and axi symmetric applications.

**INTRODUCTION (Not for examination)**

**5**

Solution to engineering problems - mathematical modeling - discrete and continuum modeling - need for numerical methods of solution - relevance and scope of finite element methods - engineering applications of FEA.

**UNIT I INTRODUCTION TO FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS**

**9**

Weighted residual methods -General weighted residual statement - Weak formulation of the weighted residual statement -Comparisons - Piecewise continuous trial functions - Example of a bar finite element - Functional and differential forms - Principle of stationary total potential - Rayleigh Ritz method - Piecewise continuous trial functions - Finite element method- Choice of the elements - Application to bar element.

**UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS**

**9**

General form of total potential for 1-D applications - Generic form of finite element equations - Linear bar element - Quadratic element -Nodal approximation - Development of shape functions - Element matrices and vectors - Example problems - Extension to plane truss- Development of element equations - Assembly - Element connectivity - Global equations - Solution methods - Beam element - Nodal approximation - Shape functions - Element matrices and vectors - Assembly - Solution - Example problems.

**UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS**

**9**

Introduction - Approximation of geometry and field variable - 3 noded triangular elements - Four noded rectangular elements - Higher order elements - Generalized coordinates approach to nodal approximations - Difficulties - Natural coordinates and coordinate transformations - Triangular and quadrilateral elements - ISO-parametric elements - Structural mechanics applications in 2-dimensions - Elasticity equations - Stress strain relations - Plane problems of elasticity - Element equations - Assembly - Need for quadrature formule - Transformations to natural coordinates - Gaussian quadrature - Example problems in plane stress, plane strain and ax symmetric applications.

**UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD**

**9**

Introduction - Vibrational problems - Equations of motion based on weak form - Longitudinal vibration of bars - Transverse vibration of beams - Consistent mass matrices - Element equations - Solution of eigenvalue problems - Vector iteration methods - Normal modes - Transient vibrations - Modeling of damping - Mode superposition technique - Direct integration methods.

## UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS

9

One dimensional heat transfer element - Application to one-dimensional heat transfer problems- Scalar variable problems in 2-Dimensions - Applications to heat transfer in 2-Dimension - Application to problems in fluid mechanics in 2-D.

**TOTAL : 45**

### TEXT BOOKS

1. Chandrupatla T.R., and Belegundu A.D., Introduction to Finite Elements in Engineering, Pearson Education 2002, 3rd Edition.
2. David V Hutton "Fundamentals of Finite Element Analysis"2004. McGraw-Hill Int. Ed.
3. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd.,New Delhi, 2007. ISBN-978-203-2315-5.

### REFERENCES

1. Rao S.S., The Finite Element Method in Engineering, Pergammon Press, 1989
2. Logan D.L., A First course in the Finite Element Method, Third Edition, Thomson Learning, 2002.
3. Robert D.Cook., David.S, Malkucs Michael E Plesha , "Concepts and Applications of Finite Element Analysis", 2003.
4. Ed. Wiley.Reddy J.N., An Introduction to Finite Element Method, McGraw-Hill International Student Edition, 1985.
5. O.C.Zienkiewicz and R.L.Taylor, The Finite Element Methods, Vol.1. The basic formulation and linear problems, Vol.1, Butterworth Heineman, 5th Edition, 2000.
6. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions (Engineering Mechanics Series), 1993.ISBN-0-07-051355-4

## AT 2753 AUTOMOTIVE AERODYNAMICS

L T P C  
3 0 0 3

### GOAL

To provide the students with basic principles of aerodynamics for the design of vehicle body.

### OBJECTIVES

The course should enable the student to:

1. Understand the fundamentals of fluid mechanics related to vehicles.
2. Understand the aerodynamics drag of cars.
3. Learn about the shape optimization of cars.
4. Equip with the knowledge of vehicle handling.
5. Understand the principle of wind tunnel technology.

## OUTCOME

Upon completion, the student should be able to:

1. Deal with various flow phenomenon related to vehicles.
2. Be familiar with types of drag force and be able to analyse aerodynamic drag.
3. Optimize various shape configurations in automobiles.
4. Learn in detail about vehicle handling.
5. Involve the principle of wind tunnel technology and also various measurement techniques involved in it.

### UNIT I INTRODUCTION 9

Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine.

### UNIT II AERODYNAMIC DRAG OF CARS 9

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

### UNIT III SHAPE OPTIMIZATION OF CARS 9

Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

### UNIT IV VEHICLE HANDLING 9

The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments - vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

### UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS 9

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

**TOTAL: 45**

## TEXT BOOK

1. Hucho.W.H. - "Aerodynamic of Road Vehicles" - Butterworths Co., Ltd., - 1997.

## REFERENCES

1. A. Pope - "Wind Tunnel Testing"- John Wiley & Sons - 2nd Edition, New York - 1974.
2. Automotive Aerodynamic: Update SP-706 - SAE - 1987
3. Vehicle Aerodynamics - SP-1145 - SAE - 1996.



## ELECTIVE SYLLABUS FOR VIII SEMESTER

### AT 2851 SIMULATION OF IC ENGINES

L T P C  
3 0 0 3

#### GOAL

To understand combustion phenomenon inside the cylinder and its computer simulation.

#### OBJECTIVES

The course should enable the students to :

1. Understand the C/H/N/O system, flame temperature, the different types of reaction occurring in an engine, while combustion.
2. Understand the simulation in an SI engine with fuel air as working medium.
3. Know about how the pressure is being getting developed in an engine.
4. Understand the simulation of a 2 stroke engine.
5. Understand the simulation in an CI engine with fuel air as working medium.

#### OUTCOME

The students should be able to :

1. Know about the heat of reaction in an engine and how the complete combustion occurring in an engine.
2. Know about the adiabatic flame temperature for constant volume and constant pressure process for combustion and the deviation between an actual and an air standard cycle of an IC engine.
3. Know the concept of fuel vaporization and its effect in the performance of an engine during combustion and the working of an engine during part-throttle and full throttle condition.
4. Know the concept of progressive combustion, gas exchange process during combustion how the computer coding is done to understand the concept of combustion in an IC engine.
5. Know about the simulation in a 2 stroke engine such as scavenging and the main difference between an SI and CI engine, and to know about the heat transfer and gas exchange process.

#### UNIT I INTRODUCTION

9

Introduction. Heat of reaction, complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, Constant pressure adiabatic combustion. Calculation of adiabatic flame temperature.

#### UNIT II SI ENGINE SIMULATION WITH FUEL AIR AS WORKING MEDIUM

9

Deviation between actual and air standard cycles of operation- problems, SI engine simulation with adiabatic constant volume combustion with fuel and air being considered, Calculation of temperature drop due to fuel vaporization, Calculation of mean effective pressure, Torque and thermal efficiency at full throttle, Part throttle and supercharged conditions.

**UNIT III ACTUAL CYCLE SIMULATION IN SI ENGINES 9**

Progressive combustion; Gas exchange process, Heat transfer process, Friction. Validation of the computer code with experimental data based on performance parameters and pressure crank angle diagram.

**UNIT IV SIMULATION OF 2-STROKE SI ENGINE 9**

Simulation of the scavenging process, determination of the pressure-crank angle variation, computation of performance parameters.

**UNIT V DIESEL ENGINE SIMULATION 9**

Main difference between SI and CI engine simulation, differences between ideal and actual cycles, Zero dimensional combustion model for diesel engine, Heat transfer and gas exchange processes. Performance prediction and comparison of results.

**TOTAL: 45**

**TEXT BOOKS**

1. Ganesan. V. - Computer Simulation of spark ignition engine process, -Universities Press (I) Ltd, Hyderabad - 1996.
2. Ganesan. V. - Computer Simulation of compression ignition engine process - Universities Press (I) Ltd, Hyderabad - 2000.
3. Ashley Campbel - Thermodynamic analysis of combustion engines - John Wiley and Sons, New York - 1986.

**REFERENCES**

1. Benson.R.S., Whitehouse. N.D., - Internal Combustion Engines - Pergamon Press, oxford - 1979.
2. Ramoss.A.L., - Modelling of Internal Combusion Engines Processes - McGraw-Hill Publishing Co., - 1992.

**AT 2852 ADVANCED THEORY OF I.C. ENGINES**

**L T P C**  
**3 0 0 3**

**GOAL**

To provide the students with the understanding of the significance of various process in IC. Engines.

**OBJECTIVES**

The course should enable the student to:

1. Develop knowledge in various cycles, such as otto, diesel Stirling and brayton cycles.
2. Understand the combustion process in engines.
3. Learn about the basic concepts of engine simulation.

4. Learn advances in I.C. engines.
5. Know about various electronics used in engines.

**OUTCOME**

Upon completion , the student should be able to:

1. Compare with various cycles with actual cycles..
2. Be familiar with combustion reactions and stiochiometry.
3. Optimize the concepts of engine simulation governing equations.
4. Evaluate performance and emission characteristics of engines
5. Apply appropriate electronic system in engine to needs.

**UNIT I CYCLE ANALYSIS 9**

Otto, Diesel, dual, Stirling and Brayton cycles, Comparison of air standard, Fuel air and actual cycles, Simple problems on the above topics.

**UNIT II COMBUSTION 9**

Combustion reactions and stoichiometry, Heat of reaction, adiabatic flame temperature in constant pressure and constant volume systems, Fuels for internal combustion engines and their properties, Premixed and diffusion combustion as applicable to SI and CI engines, Concepts of burning rate and flame velocity, Fuel spray characteristics and combustion in diesel engines.

**UNIT III COMBUSTION MODELLING 9**

Basic concepts of engine simulation, Governing equations, Simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanic based models.

**UNIT IV ADVANCES IN IC ENGINES 9**

LHR engines, Surface ignition concept and multi fuel engines, Stratified charge and lean burn engines, Performance and emission characteristics, Merits and demerits.

**UNIT V ELECTRONIC ENGINE MANAGEMENT 9**

Computer control of SI & CI engines for better performance and low emissions, Closed loop control of engine parameters of fuel injection and ignition

**TOTAL: 45**

**TEXT BOOKS**

1. Ganesan .V - "IC Engines" - Tata McGraw-Hill, 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' - Universities Process Ltd, Hyderabad - 1993.
2. Ganesan.V - Computer Simulation of compression ignition engines - Orcent Longman - 2000.
3. Richard Stone - "Introduction to IC Engines" - 2nd edition - Macmilan - 1992.

## AT 2853 ELECTRONIC ENGINE MANAGEMENT SYSTEM

L T P C  
3 0 0 3

## GOAL

This module enables the students to interface sensors in modern automotive electronic systems. The students will be taught automotive sensors, characterization, sensor selection, interfacing, sensing, data logging and data processing for specified applications.

## OBJECTIVES

The course should enable the student to:

1. Understand the automotive instruments and sensors.
2. Understand the measurement of engine parameter by using sensor.
3. Understand the working Electronic Ignition System.
4. Understand the Principles of Digital Control systems and the application of on board diagnosis.
5. Understand the concept of Engine Mapping

## OUTCOME

The students should be able to:

1. Describe the sensor classification and sensor product selection guide.
2. Describe the measurements of automotive sensors and the working of Pressure, position, flow, temperature, humidity, speed, acceleration, oxygen, torque, light, distance and level.
3. Descry the electronic fuel injection system in SI and CI engines and the advantages of using direct fuel injection over the indirect fuel injection system.
4. Describe the advantages of electronic ignition system over the conventional ignition system and the algorithms for digital controllers
5. Describe the digital control techniques

## UNIT I SENSORS

9

Types - Air flow, Pressure, Temperature, Speed Oxygen, Detonation, Position - Principle of operation, Arrangement and material.

**UNIT II GASOLINE INJECTION SYSTEM 9**

Open loop and closed loop systems, Mono point, Multi point and Direct injection systems - Principles and Features, Bosch injection systems.

**UNIT III DIESEL INJECTION SYSTEM 9**

Inline injection pump, Rotary pump and injector - Construction and principle of operation, Common rail and unit injector system - Construction and principle of operation.

**UNIT IV IGNITION SYSTEMS 9**

Ignition fundamentals, Types of solid state ignition systems, High energy ignition distributors, Electronic spark timing and control.

**UNIT V ENGINE MAPPING 9**

Combined ignition and fuel management systems. Digital control techniques - Dwell angle calculation, Ignition timing calculation and Injection duration calculation. Hybrid vehicles and fuel cells.

**TOTAL: 45**

**TEXT BOOK**

1. Bosch Technical Instruction Booklets.
2. Tom Denton, Automotive Electrical and Electronic Systems, Edward Arnold, 1995.

**REFERENCES**

1. Robert N.Brady, Automotive Computers and Digital Instrumentation, Prentice Hall, 1988.
2. Duffy Smith, Auto Fuel Systems, The god Heart Willcox Company Inc., Publishers, 1987.
3. Heinz Heisler, Advanced Engine Technology. SAE Publications, 1995.

**AT 2854 VIBRATION AND NOISE CONTROL**

**L T P C  
3 0 0 3**

**GOALS**

The students will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components.

**OBJECTIVES**

The course should enable the students to:

- 1 Understand the various types of vibration with damping and without damping.
2. Understand the Various types of noise and it's measurement and analysis techniques.
3. Understand the various sources of noise from automobiles.
4. Understand the various noise controlling techniques.
5. Understand the various noise from mechanical components and it's suppressing techniques.

## OUTCOME

The students should be able to know:

1. Classification of vibration of free, forced, undamped, damped, linear, nonlinear vibration. Response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, Determination of natural frequencies.
2. Introduction to amplitude, frequency, wavelength and sound pressure level, Addition, subtraction and averaging decibel levels, Noise dose level, legislation, measurement and analysis of noise, Measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.
3. Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise engine radiated noise, intake and exhaust noise, Assessment of mechanical noise, accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.
4. Vibration isolation by tuned absorbers, untuned viscous dampers. Damping treatments, application dynamic forces generated by IC engines, engine isolation, Crank shaft damping, Modal analysis of the mass elastic model shock absorbers.
5. Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis. Noise Suppressing Techniques like palliative treatments and enclosures, automotive noise control principles. Sound in enclosures, sound energy absorption, sound transmission through barrier.

### UNIT I INTRODUCTION

9

Single degree of freedom, two degree of freedom, free, forced and damped vibrations modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber. Two degree of freedom system. modal analysis.

### UNIT II NUMERICAL METHODS

9

Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched system.

### UNIT III CONTROL TECHNIQUES

9

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

### UNIT IV AUTOMOTIVE NOISE SOURCES

9

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

### UNIT V SOURCE OF NOISE AND CONTROL

9

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative

treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.

**TOTAL : 45**

**TEXT BOOKS**

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBN -81-297-0179-0 - 2004.
2. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

**AT 2855 AUTOMOTIVE AIR CONDITIONING**

**L T P C**  
**3 0 0 3**

**GOAL**

To Enable the student to understand the components of the automotive air-conditioning and their functions and the latest developments in this field.

**OBJECTIVES**

The course should enable the students to :

1. Understand the fundamentals of air conditioning system.
2. Understand the necessity of heating system in a vehicle.
3. Be familiar with the components of automotive air conditioning system.
4. Understand the properties of the different refrigerant.
5. To motivate students to involve in air conditioner maintenance and service.

**OUTCOME**

The students should be able to :

1. Identify and describe the basic principles of air conditioning system.
2. Apply the concept of heating systems in air conditioner.
3. Describe the working principles of the components of the automotive air conditioning system.
4. Identify the types of refrigerants, its applications and properties.
5. Identify and describe the current developments relating to the automotive air conditioning.

**UNIT I AIRCONDITIONING FUNDAMENTALS**

**9**

Basic air conditioning system - Location of air conditioning components in a car, Schematic layout of a refrigeration system, Compressor components, Condenser and high pressure service ports, Thermostatic expansion valve, Expansion valve calibration, Controlling evaporator temperature, Evaporator pressure regulator, Evaporator temperature regulator.

**UNIT II AIR CONDITIONER - HEATING SYSTEM****9**

Automotive heaters, Manually controlled air conditioner, Heater system, Automatically controlled air conditioner and heater systems, Automatic temperature control, Air conditioning protection, Engine protection.

**UNIT III REFRIGERANT****9**

Containers handling refrigerants, Tapping into the refrigerant container, Refrigeration system diagnosis, Diagnostic procedure, Ambient conditions affecting system pressures.

**UNIT IV AIR ROUTING AND TEMPERATURE CONTROL****9**

Objectives, evaporator airflow through the re-circulating unit, Automatic temperature control, Duct system, Controlling flow, Vacuum reserve, Testing the air control and handling systems.

**UNIT V AIR CONDITINING SERVICE****9**

Air conditioner maintenance and service, Servicing heater system removing and replacing components, Trouble shooting of air controlling system, Compressor service.

**TOTAL: 45****TEXT BOOK**

1. William H. Crouse and Donald L. Anglin - "Automotive Air conditioning" - McGraw Hill Inc. - 1990.

**REFERENCES**

1. Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind. - 1989.
2. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.
3. MacDonald, K.I., - "Automotive Air Conditioning" - Theodore Audel series - 1978
4. Goings.L.F. - "Automotive Air Conditioning" - American Technical services - 1974.
5. Boyce H.Dwiggins - "Automotive Air Conditioning" - Delmar - 2002.

**AT 2856 AUTOMOTIVE SENSORS AND APPLICATIONS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**GOAL**

This module enables the students to interface sensors in modern automotive electronic systems. The students will be taught automotive sensors, characterization, sensor selection, interfacing, sensing, data logging and data processing for specified applications.

**OBJECTIVES**

The course should enable the students to:

1. Understand the automotive instruments and sensors.



2. Understand the measurement of engine parameter by using sensor.
3. Understand the working of actuators.
4. Understand the working of chassis for sensors.
5. Understand the application of intelligent sensors.

### **OUTCOME**

The students should be able to:

1. Describe the sensor classification and sensor product selection guide and the measurements of automotive sensors.
2. Describe the working of Pressure, position, flow, temperature, humidity, speed, acceleration, oxygen, torque, light, distance and level, the principles of actuation control, the working of stepper and DC motor, working of relays and solenoids and the working of adaptive cruise control, traction control, braking control, steering and stability by using sensors.
3. Describe the intelligent transport system using sensors, working of the Lighting, wipers, climate control and electronic displays using sensors.
4. Describe the Sensors role in occupant safety.
5. Describe the working of digital vehicle and intelligent vehicle system.

### **UNIT I INTRODUCTION**

Introduction to automotive sensors and instrumentation, Market perspective for sensors and instrumentation techniques. Sensor electronics and techniques. Overview of sensor measurements .Sensor linearization and characterization. Sensor classification. Signals and systems. Sensor product selection guide.

### **UNIT II SENSORS FOR ENGINES 9**

Sensors and interfacing- Pressure, position, flow, temperature, humidity, speed, acceleration, oxygen, torque, light, distance and level.

### **UNIT III ACTUATORS 9**

Principles of actuation and control. DC motors, stepper motors. Relays and solenoids. Hydraulic and pneumatic.

### **UNIT IV SENSORS FOR CHASSIS 9**

Sensors and interfacing techniques for Engine control, adaptive cruise control, braking control, traction control, steering and stability.

### **UNIT V INTELLIGENT SENSORS 9**

Sensors for intelligent transport systems. Lighting, wipers, climate control and electronic displays. Sensors for occupant safety .The digital vehicle. Intelligent vehicle systems.

**TOTAL : 45**

## TEXT BOOKS

1. E Q Doebelin, Measurement Systems, Application and Design, 4th edition, McGraw-Hill, 2002
2. William B. Ribbens, Understanding Automotive Electronics, 5th edition, Newnes, 2006
3. Ronald k. Jurgen, Automotive Electronics Handbook, 2nd edition, McGraw-Hill, 2007.

## AT 2857 FUEL CELLS AND APPLICATIONS

L T P C  
3 0 0 3

### GOAL

To impart knowledge about the concept & working of the Fuel Cells, its construction, types and its application in automobiles, impact on its performance.

### OBJECTIVES

The course should enable the students to:

1. Understand various types of Fuel Cells, its principle, construction & working.
2. Understand the automotive applications of Fuel Cells, improvements & advances & commonly used types.
3. Know about the various components & its performance characteristics in a fuel cell vehicle.
4. Gain knowledge about the different types of fuels used in Fuel Cells and the concept of Fueling.
5. Do an analysis & comparative study of fuel cells with other types of alternate fuels, the types & working of different types of Fuel Cells and the performance characteristics of the Fuel cells.

### OUTCOME

The students should be able to :

1. Analyze the thermodynamics & electrochemical kinetics of fuel cells.
2. Be familiar with the automotive applications of Fuel Cells.
3. Update himself to the current advances in Fuel Cell Vehicle Technologies.
4. Be familiar with the various components of the fuel cells
5. Be familiar with the various types of Fueling techniques followed in the Fuel cells, Do a comparative study of the Fuel cells with other Alternate Fuels.

### 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**

**TEXT BOOKS**

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.

**AT 2858 ROBOTICS**

**L T P C  
3 0 0 3**

**GOAL**

Technological change and Automation are unavoidable in Industry. This subject enables the student to understand about Robotics, its application, components.

**OBJECTIVES**

The course should enable the students to:

1. Understand Automation and Robotics with preserve and future application.
2. Study the various components, constructional aspects of Industrial Robotics.
3. Understand various motions and coordination.
4. Understand the activating system and components and sensor of a Robot.
5. Understand the application of robots in manufacturing relating to automobile industry.

## OUTCOME

The students should be able to:

1. Select tools for required application.
2. Configure robots with components and devices..
3. Solve kinematics problems.
4. Able to make automation modules based on sensor input.
5. Able to design and fabricate small robots for material handling, spray painting, spot welding, assembly, inspection etc.,

### **UNIT I INTRODUCTION 9**

Automation and Robotics, CAD/CAM and Robotics - An over view of Robotics - present and future applications - classification by coordinate system and control system.

### **UNIT II COMPONENTS OF THE INDUSTRIAL ROBOTICS 9**

Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom -requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

### **UNIT III MOTION ANALYSIS 9**

Homogeneous transformations as applicable to rotation and translation - problems. Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics - problems.

### **UNIT IV ROBOT ACTUATORS AND FEED BACK COMPONENTS 9**

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors - potentiometers, resolvers, encoders - Velocity sensors.

### **UNIT V ROBOT APPLICATION IN MANUFACTURING 9**

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

**TOTAL : 45**

## TEXT BOOKS

1. Groover M P - "Industrial Robotics", Pearson Edu.
2. Mittal R K & Nagrath I J - "Robotics and Control", TMH.

## REFERENCES

1. Fu K S - "Robotics", McGraw Hill.
2. P. Coiffet and M. Chaironze - "An Introduction to Robot Technology", Kogam Page Ltd. 1983 London.
3. Richard D. Klafter - "Robotic Engineering", Prentice Hall

4. Asada and Slow time - "Robot Analysis and Intelligence", Wiley Inter-Science.
5. John J Craig - "Introduction to Robotics", Pearson Edu.
6. Mark W. Spong and M. Vidyasagar - "Robot Dynamics & Control", John Wiley & Sons (ASIA) Pte Ltd.

### **AT 2859 ALTERNATIVE FUELS AND ENERGY SYSTEMS**

**L T P C**  
**3 0 0 3**

#### **GOAL**

To provide the students with the knowledge of alternate fuels and the changes in the engine design and to understand various energy systems for use in the automobiles.

#### **OBJECTIVES**

The course should enable the student to:

1. Gain knowledge of various alternate fuels.
2. Understand properties, performance and emission characteristics of Alcohols.
3. Know about Natural gas, LPG, hydrogen and biogas.
4. Study in depth of various vegetable oils used for engines.
5. Know about Electric vehicle.

#### **OUTCOME**

Upon completion, the student should be able to:

1. Apply various alternate fuels appropriately to the needs.
2. Learn in details about methanol and ethanol usage, storage, chemical structure, pros and cons.
3. Be acquainted with the knowledge of natural gas, LPG, hydrogen and biogas.
4. Evaluate the performance characteristics of various vegetable oils.
5. Be familiar with electric and hybrid vehicles.

#### **UNIT I INTRODUCTION**

**9**

Need for alternate fuel, Availability and properties of alternate fuels, general use of alcohols, LPG, Hydrogen, Ammonia, CNG and LNG, Vegetable oils and biogas, Merits and demerits of various alternate fuels, Introduction to alternate energy sources. Like EV, Hybrid, Fuel cell and solar cars.

#### **UNIT II ALCOHOLS**

**9**

Properties as engine fuel, Alcohols and gasoline blends, Performance in SI engine, Methanol and gasoline blends, Combustion characteristics in CI engines, Emission characteristics, DME, DEE properties performance analysis, Performance in SI & CI Engines.

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

Availability of CNG, properties, Modification required using in engines, Performance and emission characteristics of CNG using LPG in SI & CI engines, Performance and emission of LPG. Hydrogen; Storage and handling, Performance and safety aspects.

**UNIT IV VEGETABLE OILS 9**

Various vegetable oils for engines, Esterification, Performance in engines, Performance and emission characteristics, Bio diesel and its characteristics

**UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS 9**

Layout of an electric vehicle, Advantage and limitations, Specifications, System components, Electronic control system, High energy and power density batteries, Hybrid vehicle, Fuel cell vehicles, Solar powered vehicles.

**TOTAL : 45**

**TEXT BOOK**

1. Richard.L.Bechfold - Alternative Fuels Guide Book - SAE International Warrendale - 1997.

**REFERENCES**

1. Maheswar Dayal - "Energy today & tomorrow" - I & B Horishr India - 1982.
2. Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.
3. "Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
4. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

**MG 2005 ENGINEERING ECONOMICS & COST ANALYSIS**

**L T P C**  
**3 0 0 3**

**GOAL**

To expose the students to basic economics and cost analysis related to engineering industries.

**OBJECTIVES**

The course should enable the students to:

1. Learn about the basic of economics and cost analysis related to engineering so as to take economically sound decisions.
2. Understand the concept of depreciation and determination of economic life of asset.

**OUTCOME**

The students should be able to:

1. Understand the meaning of various terminologies like sinking fund factor, Present worth factor, capital recovery factor, And Effective Interest Rate.
2. Appreciate the need of replacement and maintenance analysis.

**UNIT I INTRODUCTION TO ECONOMICS****8**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics - Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break- even analysis- Vratio, Elementary economic Analysis-Materials election for product Design selection for a product, Process planning.

**UNIT II VALUE ENGINEERING****10**

Make or buy decision, Value engineering - Function, aims, Value engineering procedure. Interest formulae and their applications-Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor-equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

**UNIT III CASH FLOW****9**

Methods of comparison of alternatives - present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

**UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS****9**

Replacement and Maintenance analysis - Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset - capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

**UNIT V DEPRECIATION****9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives-introduction, Examples, Inflation adjusted decisions - procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

**TOTAL: 45****TEXT BOOK**

1. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.

**REFERENCES**

1. Chan S.Park, Contemporary Engineering Economics, Prentice Hall of India, 3rd Edition 2008.
2. Donald. G.Newman, Jerome.P. Lavelle, Engineering Economics and analysis Engg. Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G. and Canada, J.R, Engineering Economy, Macmillan, New York, 1984
4. Grant. E.L., Ireson. W.G., and Leavenworth, R.S, Principles of Engineering Economy,
5. Ronald Press, New York, 1976. Smith, G.W., Engineering Economy, Iowa State Press, Iowa, 1973.