INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA | Affiliated to JNTUH)

Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI UNDER AUTONOMOUS STATUS

B.Tech Regular Four Year Degree Programme

(for the batches admitted from the academic year 2016- 2017)

&

B.Tech (Lateral Entry Scheme)

(for the batches admitted from the academic year 2017 - 2018)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

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"Take up one idea.
Make that one idea your life-think of it, dream of it, live on that idea. Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone.
This is the way to success"

Swami Vivekananda

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and one supplementary semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Betterment: Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Branch: Means specialization in a program like B.Tech degree program in Civil Engineering, B.Tech degree program in Computer Science and Engineering etc.

Certificate course: It is a course that makes a student gain hands-on expertise and skills required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Detention in a course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Means Institute of Aeronautical Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Bachelor of Technology (B.Tech) degree program / PG degree program: M.Tech/ MBA.

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all B.Tech programs offered by Institute are designated as "IARE Regulations R-16" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd Semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of the odd or even semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

FOREWORD

The autonomy is conferred to Institute of Aeronautical Engineering (IARE), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Hyderabad (JNTUH), Hyderabad and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system** and **monitoring mechanism**, independent of the affiliating University but under its observance.

IARE is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS

B.Tech. Regular Four Year Degree Programme
(for the batches admitted from the academic year 2016 - 17)
&
B.Tech. (Lateral Entry Scheme)
(for the batches admitted from the academic year 2017 - 18)

For pursuing four year undergraduate Bachelor Degree programme of study in Engineering (B.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

1.0. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching-learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / comprehensive Examination / seminars / assignments / alternative assessment tools / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

1. Choose electives from a wide range of elective courses offered by the departments.
2. Undergo additional courses of interest.
3. Adopt an interdisciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

2.0 MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

3.0 TYPES OF COURSES

Courses in a programme may be of three kinds: **Foundation / Skill, Core and Elective.**

3.1 Foundation / Skill Course:

Foundation courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all. They are fundamental to learning any subject.

3.2 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

3.3 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from an unrelated discipline called as "Open Elective".

There are six professional elective groups; students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor/mentor. Nevertheless, one course from each of the two open electives has to be selected. A student may also opt for more elective courses in his area of interest.

4.0 SEMESTER STRUCTURE

Each academic year is divided into three semesters, TWO being MAIN SEMESTERS (one odd + one even) and ONE being a SUPPLEMENTARY SEMESTER. Main Semesters are for regular class work. Supplementary Semester is primarily for failed students i.e. registration for a course for the first time is generally not permitted in the supplementary semester. However, the following cases are exempted:

4.1 Students admitted under Lateral Entry Scheme in the subjects 'Audit Course', 'Advanced Programming Lab' and 'Value Added Course'.

4.2 Students admitted under Lateral Entry Scheme shall register 'Environmental Studies' course in supplementary semester and pass the subject by the end of VI semester for the award of the degree. This is a non-credit and mandatory course for students admitted under Lateral Entry Scheme.

4.3 Students admitted on transfer from JNTU affiliated institutes, Universities and other institutes in the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned 'Board of Studies'.

4.4 Each main semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation and conduct of examinations.

4.5 Each main semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical are 75 and 15 days for conduct of exams and preparation.

4.6 The supplementary semester shall be a fast track semester consisting of eight weeks and this period includes time for registration of courses, course work, examination preparation, conduct of examinations, assessment and declaration of final results.

4.7 All subjects may not be offered in the supplementary semester. The student has to pay a stipulated fee prescribed by the Institute to register for a course in the supplementary semester. The supplementary semester is provided to help the student in not losing an academic year. It is optional for a student to make use of supplementary semester. **Supplementary semester is a special semester and the student cannot demand it as a matter of right** and will be offered based on availability of faculty and other institute resources.

4.8 The institute may use **supplementary semester** to arrange add-on courses for regular students and / or for deputing them for practical training / FSI. A student can register for a maximum number of 15 credits during a supplementary semester.

4.0.1 The registration for the Summer Semester (May – July) provides an opportunity to students to clear their backlogs (‘F’ grade) or who are prevented from appearing for SEE examinations due to shortage of attendance less than 65% in each course (‘SA’ Grade) in the earlier semesters or the courses which he / she could not register (Drop/Withdraw) for some reason.

Students will not be permitted to register for more than 15 credits (both I and II Semester) in the Summer Semester. Students are required to register for Summer Semester courses are to pay a nominal fee in within the stipulated time.

It will be optional for a student to get registered in the course(s) of Summer Semester; otherwise, he / she can opt to appear directly in supplementary examination. However, if a student gets registered in a course of Summer Semester, then it will be compulsory for a student to fulfil attendance criteria (≥90%) of Summer Semester and he / she will lose option to appear in immediate supplementary examination.

The students who have earlier taken an SEE Examination and register afresh for the Summer Semester will revoke the CIA marks secured by them in their regular/earlier attempt in the same course. Once revoked, the students shall not seek restoration of the CIA marks.

Summer Semester will be at an accelerated pace and will be at double the rate of normal semester e.g. one credit of course shall require two hours/week so that the total contact hours are maintained same as in normal semester.

Instructions and guidelines for the summer semester course:

- A minimum of 36 to 40 hours will be taught by the faculty for every course.
- The students registered and having sufficient percentage of attendance for the course alone will be permitted to write the examination.
- The assessment procedure in a summer semester course will also be similar to the procedure for a regular semester course.
- Student shall register for the Summer Semester as per the schedule given in academic calendar.
- Once registered, students will not be allowed to withdraw from a summer semester.

4.0.2 The academic calendar shown in Table 1 is declared at the beginning of the academic year.

Table 1: Academic Calendar

<table>
<tr><td rowspan="6">FIRST SEMESTER (21 weeks)</td><td>I Spell Instruction Period</td><td>8 weeks</td><td rowspan="5">19 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 week</td></tr>
<tr><td>Preparation and Practical Examinations</td><td>1 week</td></tr>
<tr><td colspan="2">Semester End Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="3">Semester Break and Supplementary Exams</td><td>2 weeks</td></tr>
<tr><td rowspan="6">SECOND SEMESTER (21 weeks)</td><td>I Spell Instruction Period</td><td>8 weeks</td><td rowspan="5">19 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 week</td></tr>
<tr><td>Preparation & Practical Examinations</td><td>1 week</td></tr>
<tr><td colspan="2">Semester End Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="3">Summer Vacation, Supplementary Semester and Remedial Exams</td><td>8 weeks</td></tr>
</table>

5.0 REGISTRATION / DROPPING / WITHDRAWAL

5.1. Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely compulsory for the student to register for courses in time. The registration will be organized departmentally under the supervision of the Head of the Department.

5.2. IN ABSENTIA registration will not be permitted under any circumstance.

5.3. At the time of registration, students should have cleared all the dues of Institute and Hostel in the previous semesters, paid the prescribed fees for the current semester and not been debarred from institute for a specified period on disciplinary or any other ground.

5.4. The student has to normally register for a minimum of 20 credits and may register up to a maximum of 30 credits, in consultation with HOD/faculty mentor. On an average, a student is expected to register for 25 credits.

5.5. **Dropping of Courses:** Within one week after the last date of first internal assessment test or by the date notified in the academic calendar, the student may in consultation with his / her faculty mentor/adviser, drop one or more courses without prejudice to the minimum number of credits as specified in clause 5.4. The dropped courses are not recorded in the Grade Card. Student must complete the dropped subject by registering in the supplementary semester / forthcoming semester in order to earn the required credits. Student must complete the dropped subject by registering in the supplementary semester / forthcoming semester in order to earn the required credits.

5.6. **Withdrawal from Courses:** A student is permitted to withdraw from a course by the date notified in the academic calendar. Such withdrawals will be permitted without prejudice to the minimum number of credits as specified in clause 5.4. A student cannot withdraw a course more than once and withdrawal of reregistered subjects is not permitted.

5.7. After **Dropping and / or Withdrawal** of courses, minimum credits registered shall be 20.

6.0 UNIQUE COURSE IDENTIFICATION CODE

Every course of the B.Tech program will be placed in one of the nine groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

Table 2: Group of Courses

S. No	Branch	Code
1	Aeronautical Engineering	AE
2	Computer Science and Engineering	CS
3	Information Technology	IT
4	Electronics and Communication Engineering	EC
5	Electrical and Electronics Engineering	EE
6	Mechanical Engineering	ME
7	Civil Engineering	CE
8	Humanities and Basic Sciences	HS
9	Miscellaneous	MS

7.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Foundation / Skill Courses, Core Courses, Elective Courses, Laboratory Courses, Audit Courses, Mandatory Courses, Comprehensive Examination, Ideation and Product Development, Internship and Project work. The list of elective courses may include subjects from allied disciplines also.

Contact Periods: Depending on the complexity and volume of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits based on the number of hours/week as follows:

- **Contact classes (Theory):** 1 credit per lecture hour per week, 1 credit per tutorial hour per week.
- **Laboratory Hours (Practical):** 1 credit for 2 Practical hours, 2 credits for 3 or 4 practical hours per week.
- **Project Work:** 1 credit for 4 hours of project work per week.
- **Ideation and Product Development:** 1 credit for 2 hours per week

7.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Theory Course (Core and Foundation)	3 / 4	3 / 4
2	Elective Courses	3	3
3	MOOC Courses	-	2
4	Laboratory Courses	2 / 3	1 / 2
5	Audit Course / Mandatory Course	-	0
6	Comprehensive Examination	-	1
7	Ideation and Product Development	-	1
8	Summer Internship	-	0
9	Full Semester Internship (FSI) Project Work	-	16
10	Project Work	-	10

7.2 Course Structure

Every program of study shall be designed to have 38 - 42 theory courses and 20 - 26 laboratory courses. Every course of the B.Tech program will be placed in one of the eight categories with minimum credits as listed in the Table 4. In addition, a student has to carry out a Ideation and Product Development, project work and comprehensive Examination.

Table 4: Category Wise Distribution of Credits

S. No	Category	Subject Area and % of Credits	Average No. of Credits
1	Humanities and Social Sciences (HS), including Management.	HS (05% to 10%)	10
2	Basic Sciences (BS) including Mathematics, Physics and Chemistry.	BS (15% to 20%)	28
3	Engineering Sciences (ES), including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	ES (15% to 20%)	28
4	Professional Subjects - Core (PC), relevant to the chosen specialization/branch.	PC (30% to 40%)	96
5	Professional Subjects - Electives (PE), relevant to the chosen specialization/branch.	PE (10% to 15%)	12
6	Open Subjects - Electives (OE), from other technical and/or emerging subject areas.	OE (05% to 10%)	06
7	Project Work or Full Semester Internship, Ideation and Product Development, Comprehensive Examination.	10% to 15%	12 - 18
8	Mandatory Courses / Audit Courses.	MC / AC	Non-Credit
TOTAL			**192**

7.3 Semester wise course break-up

Following are the **TWO** models of course structure out of which any student shall choose or will be allotted with one model based on their academic performance.

i. Full Semester Internship (FSI) Model and

ii. Non Full Semester Internship (NFSI) Model.

7.4 For Four year regular program (FSI Model):

In the FSI Model, out of the selected students - half of students shall undergo Full Semester Internship in VII semester and the remaining students in VIII semester. In the Non FSI Model, all the selected students shall carry out the course work and Project work as specified in the course structure. A student who secures a minimum CGPA of 7.5 up to IV semester with no current arrears and maintains the CGPA of 7.5 till VI Semester shall be eligible to opt for FSI.

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Semester	5 Foundation	4	24
II Semester	5 Foundation	4	24
III Semester	5 + Mandatory Course (2 Core + 3 Foundation)	3	25
IV Semester	5 + Audit Course (3 Core + 2 Foundation)	3	25
V Semester	6 (5 Core + 1 Professional Elective)	3	29
VI Semester	6 (3 Core + 1 Professional Elective + 1 Open Elective + 1 Foundation)	3 + Ideation and Product Development	28
VII Semester	Full Semester Internship (FSI)		16
VIII Semester	4 (3 Core + 1 Professional Elective)	3 + Comprehensive Examination	21
Total	**36 (16 Foundation + 16 Core + 3 Professional Electives + 1 Open Electives) + Mandatory Course + Audit course**	**22 + Comprehensive Examination + Ideation and Product Development + FSI**	**192**

7.5 For Four year regular program (Non FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Semester	5 Foundation	4	24
II Semester	5 Foundation	4	24
III Semester	5 + Mandatory Course (2 Core + 3 Foundation)	3	25
IV Semester	5 + Audit Course (3 Core + 2 Foundation)	3	25
V Semester	6 (4 Core + 1 Skill 1 Professional Elective)	3	25
VI Semester	5 (3 Core + 1 Professional Elective + 1 Open Elective)	3 + Ideation and Product Development	25
VII Semester	5 (3 Core + 1 Professional Elective + 1 Open Elective)	3	24
VIII Semester	3 (2 Core + 1 Professional Elective)	Project Work + Comprehensive Examination	20
Total	**39 (15 Foundation + 01 Skill + 17 Core + 4 Professional Electives + 2 Open Electives) + Mandatory Course + Audit Course**	**23 + Ideation and Product Development + Comprehensive Examination + Project work**	**192**

7.6 For Three year lateral entry program (FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
III Semester	5 + Mandatory Course (2 Core + 3 Foundation)	3	25
IV Semester	5 + Audit course (3 Core + 2 Foundation)	3	25
V Semester	6 (5 Core + 1 Professional Elective)	3	29
VI Semester	6 (3 Core + 1 Professional Elective + 1 Open Elective + 1 Foundation)	3 + Ideation and Product Development	28
VII Semester	Full Semester Internship (FSI)		16
VIII Semester	4 (3 Core + 1 Professional Elective)	3 + Comprehensive Examination	21
Total	**26 (6 Foundation + 16 Core + 3 Professional Electives + 1 Open Electives) + Mandatory Course + Audit Course**	**14 + Comprehensive Examination + Ideation and Product Development + FSI**	**144**

7.7 For Three year lateral entry program (Non FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
III Semester	5 + Mandatory Course (2 Core + 3 Foundation)	3	25
IV Semester	5 + Audit Course (3 Core + 2 Foundation)	3	25
V Semester	6 (4 Core + 1 Skill + 1 Professional Elective)	3	25
VI Semester	5 (3 Core + 1 Professional Elective + 1 Open Elective)	3 + Ideation and Product Development	25
VII Semester	5 (3 Core + 1 Professional Elective + 1 Open Elective)	3	24
VIII Semester	3 (2 Core + 1 Professional Elective)	Project Work + Comprehensive Examination	20
Total	**29 (05 Foundation + 17 Core + 4 Professional Electives + 2 Open Electives + 1 Skill) + Mandatory Course + Audit Course**	**15 + Ideation and Product Development + Comprehensive Examination + Project work**	**144**

7.8 Course wise break-up for the total credits (FSI Model):

Total Theory Courses (36) Core Courses (16) + Foundation Courses (11+ 5) + Professional Electives (03) + Open Elective (01)	16 @ 4 credits + 11 @ 4 credits + 05 @ 3 credits + 03 @ 3 credits + 01 @ 3 credits	134
Total Laboratory Courses (16 + 08)	16 @ 2 credits + 08 @ 1 credit	40
Comprehensive Examination	1 @ 1 credit	01
Ideation and Product Development	1 @ 1 credit	01
Full Semester Internship (FSI)	1 @ 16 credits	16
TOTAL CREDITS		**192**

7.9 For Four year regular program (Non FSI Model):

Total Theory Courses (38) Core Courses (16) + Foundation Courses (11+ 5) + Professional Electives (04) + Open Electives (02) + Skill (01)	14 @ 4 credits + 02 @ 3 credits + 11 @ 4 credits + 05 @ 3 credits + 04 @ 3 credits + 02 @ 3 credits + 01 @ 3 credits	142
Total Laboratory Courses (15 + 08)	15 @ 2 credits + 08 @ 1 credit	38
Comprehensive Examination	1 @ 1 credit	01
Ideation and Product Development	1 @ 1 credit	01
Project work	1 @ 10 credits	10
TOTAL CREDITS		**192**

7.10 For three year lateral entry program (FSI Model):

Total Theory Courses (26) Core Courses (16) + Foundation Courses (5+2) + Professional Electives (03) + Open Electives (01)	14 @ 4 credits + 02 @ 3 credits + 05 @ 4 credits + 02 @ 3 credits + 03 @ 3 credits + 01 @ 3 credits	100
Total Laboratory Courses (11 + 04)	11 @ 2 credits + 04 @ 1 credit	26
Comprehensive Examination	1 @ 1 credit	01
Ideation and Product Development	1 @ 1 credit	01
Full Semester Internship	1 @ 16 credits	16
TOTAL CREDITS		**144**

7.11 For three year lateral entry program (Non FSI Model):

Total Theory Courses (28) Core Courses (16) + Foundation Courses (5+1) + Professional Electives (04) + Open Electives (02) + Skill (01)	14 @ 4 credits + 02 @ 3 credits + 05 @ 4 credits + 01 @ 3 credits + 04 @ 3 credits + 02 @ 3 credits + 01@ 3 credits	106
Total Laboratory Courses (11 + 04)	11 @ 2 credits + 04 @ 1 credit	26
Comprehensive Examination	1 @ 1 credit	01
Ideation and Product Development	1 @ 1 credit	01
Project work	1 @ 10 credits	10
TOTAL CREDITS		**144**

8.0 EVALUATION METHODOLOGY

8.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two sessional examinations or the marks scored in the make-up examination conducted.

8.1.1 Semester End Examination (SEE):

The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows.

Two full questions with ‘either’ ‘or’ choice will be drawn from each unit. Each question carries 14 marks. There could be a maximum of three sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

8.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty/teacher handling the course as given in Table-5. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz / Alternative Assessment Tool (AAT).

Table-5: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE Exam (Sessional)	Quiz / AAT	
Max. CIA Marks	25	05	30

8.1.2.1 Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Internal Examination.

8.1.2.2 Quiz / Alternative Assessment Tool (AAT)

Two Quiz exams shall be online examination consisting of 20 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in the testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quizzes for every course.

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT) in place of two quizzes. This AAT enables faculty to design own assessment patterns during the CIA. However, the usage of AAT is completely optional. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning centre. The AAT may include seminars, assignments, term paper, open ended experiments, micro-projects, five minutes video, MOOCs etc.

However, it is mandatory for a faculty to obtain prior permission from the concerned HOD and spell out the teaching/assessment pattern of the AAT prior to commencement of the classes.

8.2 Laboratory Course:

8.2.1 Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

8.2.2 All the drawing related courses are evaluated in line with laboratory courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks in each semester.

8.3 MOOC Courses:

Meeting with the global requirements, to inculcate the habit of self learning and in compliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives.

8.3.1 The proposed MOOC courses would be additional choices in all the elective groups subject to the availability during the respective semesters and respective departments will declare the list of the courses at the beginning of the semester. Course content for the selected MOOC courses shall be drawn from respective MOOCs links or shall be supplied by the department. Course will be mentored by faculty members and Assessment & Evaluation of the courses shall be done by the department.

8.3.2 There shall be one Mid Continuous Internal Examination (Quiz exam for 30 marks) after 8 weeks of the commencement of the course and semester end examination (Descriptive exam for 70 marks) shall be done along with the other regular courses.

8.3.3 Two credits will be awarded upon successful completion of each MOOC courses. Students need to complete three such MOOC courses to compensate any two elective courses (one open and one professional) having three credits.

8.3.4 Students interested in doing MOOC courses shall register the course title at their department office at the start of the semester against the courses that are announced by the department.

8.4 Audit Courses (AC) / Mandatory Courses (MC):

These courses are among the compulsory courses and do not carry any credits.

a) Gender Sensitivity is a mandatory course in III semester for all the students.

b) The student has to choose one audit course at the beginning of IV semester under self study mode. By the end of VI semester, all the students (regular and lateral entry students) shall complete the audit course.

c) The students will have four chances in total to clear the audit / mandatory course. Further, the student has an option to change the audit course in case if s/he is unable to clear the audit course in the first two chances. However, the audit course should be completed by VI semester and its result will be given in the VI semester grade sheet.

d) Audit / Mandatory courses will not carry any credits; but, a pass in each such course after attaining required CIE and SEE requirements during the programme shall be necessary requirement for the student to qualify for the award of Degree. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

8.5 Value Added Courses:

The value added courses are audit courses in nature offered through joint ventures with various organizations provide ample scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen field of studies. A plenty of value added programs will be proposed by the departments one week before the commencement of classwork. The students are given the option to choose the courses according to their desires and inclinations as they choose the desired items in a cafeteria. The expertise gained through the value added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

8.6 Comprehensive Examination

The comprehensive Examination is aimed at assessing the students understanding of various Foundation, Skill and Core courses studied till the end of VII semester and is intended to test the students' grasp of the chosen field of study.

The Comprehensive Examination consists of two parts. Part A is a written examination and part B is the oral examination. The written examination shall be objective type of one hour duration and shall have 50 marks and is to be conducted by the concerned department under the supervision of Dean Academics. Oral examination shall be conducted by the department and carry 50 marks. The examination shall be conducted during the VIII semester.

8.7 Ideation and Product Development

The Ideation and Product Development shall be carried out either during VI semester along with other lab courses by having regular weekly slots. Students will take Ideation and Product Development batch wise and the batches will be divided as per the guidelines issued. The topic of Ideation and Product Development should be so selected that the students are enabled to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of the Ideation and Product Development could be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with a specific outcome. Ideation and Product Development report will be evaluated for 100 marks in total. Assessment will be done by the supervisor/guide for 30 marks based on the work and presentation/execution of the Ideation and Product Development. Subdivision for the remaining 70 marks is based on report, presentation, execution and viva-voce. Evaluation shall be done by a committee comprising the Ideation and Product Development supervisor, Head of the department and an

examiner nominated by the Principal from the panel of experts recommended by Chairman, BOS in consultation with Head of the department.

8.8 Project work

In the non-FSI Model, the project work shall be evaluated for 100 marks out of which 30 marks for internal evaluation and 70 marks for semester end evaluation. The project work shall be spread over in VII semester and in VIII semester. The project work shall be somewhat innovative in nature, exploring the research bent of the mind of the student. A project batch shall comprise not more than three students.

At the end of VII semester, students should submit synopsis summarizing the work done in VII semester. The project is expected to be completed by the end of VIII semester. In VII semester, a first mid review is conducted by Project Review Committee (PRC) (on the progress) for 10 marks.

In VIII semester, a second mid review is conducted by PRC (on the progress) for 10 marks. On completion of the project, a third evaluation is conducted for award of internal marks of another 10 marks before the report is submitted, making the total internal marks 30.

The end semester examination shall be based on the report submitted and a viva-voce exam for 70 marks by a committee comprising the Head of the department, project supervisor and an external examiner nominated by the Principal. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits.

8.9 Full Semester Internship (FSI)

FSI is a full semester internship programme carries 16 credits. During the FSI, student has to spend one full semester in an identified industry / firm / organization and has to carry out the internship as per the stipulated guidelines of that industry / firm / organization and the institute.

Following are the evaluation guidelines:

- Quizzes: 2 times
- Quiz #1 - About the industry profile, weightage: 5%
- Quiz #2 - Technical-project related, weightage: 5%
- Seminars - 2 times (once in six weeks), weightage: 7.5% + 7.5%
- Viva-voce: 2 times (once in six weeks), weightage: 7.5% + 7.5%
- Project Report, weightage: 15%
- Internship Diary, weightage: 5 %
- Final Presentation, weightage: 40%

FSI shall be open to all the branches with a ceiling of maximum 10% distributed in both semesters. The selection procedure is:

- Choice of the students
- CGPA (> 7.5) up to IV semester
- Competency Mapping / Allotment

9.0 MAKE-UP EXAMINATION

The make-up examination facility shall be available to students who may have missed to attend CIE exams in one or more courses in a semester for valid genuine reasons. The make-up examination shall have comprehensive online objective type questions. The syllabus for the make-up examination shall be the whole syllabus covered till the end of the semester under consideration and will be conducted at the end of the semester.

10.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

10.1 It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 75% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

10.2 For cases of medical issues, deficiency of attendance in each course to the extent of 10% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the department if their attendance is between 75% to 65% in every course, subjected to submission of medical certificates, medical case file and other needful documents to the concerned departments.

10.3 The basis for the calculation of the attendance shall be the period prescribed by the institute by its calendar of events. For late admission, attendance is reckoned from the date of admission to the program. However, in case of a student having less than 65% attendance in any course, s/he shall be detained in the course and in no case such process will be relaxed.

10.4 A candidate shall put in a minimum required attendance at least three (3) theory courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

10.5 Students whose shortage of attendance is not condoned in any subject are not eligible to write their semester end examination of that courses and their registration shall stand cancelled.

10.6 A prescribed fee shall be payable towards condonation of shortage of attendance.

10.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

10.8 Any student against whom any disciplinary action by the institute is pending shall not be permitted to attend any SEE in that semester.

11.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

11.1 Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

11.2 Question papers may be moderated for the coverage of syllabus, pattern of questions by a Semester End Examination Committee chaired by Head of the Department one day before the commencement of semester end examinations. Internal Examiner shall prepare a detailed scheme of valuation.

11.3 The answer papers of semester end examination should be evaluated by the internal examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

11.4 In case of difference of more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and marks awarded by this examiner shall be taken as final.

11.5 COE shall invite 3 - 9 external examiners to evaluate all the end-semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

11.6 Examinations Control Committee shall consolidate the marks awarded by internal and external examiners and award grades.

12.0 SCHEME FOR THE AWARD OF GRADE

12.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures

i. Not less than 35% marks for each theory course in the semester end examination, and

ii. A minimum of 40% marks for each theory course considering both internal and semester end examination.

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab / Comprehensive Examination / Ideation and Product Development / Project, if s/he secures

i. Not less than 40% marks for each Lab / Comprehensive Examination / Ideation and Product Development / Project course in the semester end examination,

ii. A minimum of 40% marks for each Lab / Comprehensive Examination / Ideation and Product Development / Project course considering both internal and semester end examination.

12.3 If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

13.0 LETTER GRADES AND GRADE POINTS

13.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10-point grading system with the following letter grades as given in the Table-6.

Table-6: Grade Points Scale (Absolute Grading)

Range of Marks	Grade Point	Letter Grade
100 – 90	10	S (Superior)
89 – 80	9	A+ (Excellent)
79 – 70	8	A (Very Good)
69 – 60	7	B+ (Good)
59 – 50	6	B (Average)
49 – 40	5	C (Pass)
Below 40	0	F (Fail)
Absent	0	AB (Absent)
Authorized Break of Study	0	ABS

13.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: “S”, “A+”, “A”, “B+”, “B”, “C”.

13.3 A student obtaining Grade F shall be considered Failed and will be required to reappear in the examination.

13.4 For non credit courses, ‘Satisfactory’ or “Not Satisfactory” is indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

13.5 “SA” denotes shortage of attendance (as per item 10) and hence prevention from writing Semester End Examination.

13.6 “W” denotes **withdrawl** from the exam for the particular course.

13.7 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

14.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m} (C_j S_j) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	S	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$$Thus, SGPA = 139 / 20 = 6.95$$

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0
Semester 5	**Semester 6**		
Credit: 26 SGPA: 6.3	Credit: 25 SGPA: 8.0		

$$Thus,\ CGPA = \frac{20x6.9\ +\ 22x7.8\ +\ 25x5.6\ +\ 26x6.0\ +\ 26x6.3\ +\ 25x8.0}{144} = 6.73$$

16.0 PHOTOCOPY / REVALUATION

A student, who seeks the re-valuation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s), within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 10.

17.1 For students admitted into B.Tech (Regular) program

17.1.1 A student will not be promoted from II semester to III semester unless s/he fulfills the academic requirement of securing 24 credits from I and II semesters examinations, whether or not the candidate takes the examinations.

17.1.2 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 37 credits upto III semester **or** 49 credits upto IV semester, from all the examinations, whether or not the candidate takes the examinations.

17.1.3 A student shall be promoted from VI semester to VII semester only if s/he fulfills the academic requirements of securing 62 credits upto V semester **or** 74 credits upto VI semester from all the examinations, whether or not the candidate takes the examinations.

17.1.4 A student shall register for all the 192 credits and earn all the 192 credits. Marks obtained in all the 192 credits shall be considered for the award of the Grade.

17.2 For students admitted into B.Tech (lateral entry students)

17.2.1 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 25 credits upto IV semester, from all the examinations, whether or not the candidate takes the examinations.

17.2.2 A student shall be promoted from VI semester to VII semester only if s/he fulfills the academic requirements of securing 38 credits upto V semester **or** 50 credits upto VI semester from all the examinations, whether or not the candidate takes the examinations.

17.2.3 A student shall register for all the 144 credits and earn all the 144 credits. Marks obtained in all the 144 credits shall be considered for the award of the Grade.

18.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of the B.Tech degree.

18.1 Student shall register and acquire minimum attendance in all courses and secure 192 credits for regular program and 144 credits for lateral entry program.

18.2 A student of a regular program, who fails to earn 192 credits within eight consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

18.3 A student of a lateral entry program who fails to earn 144 credits within six consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

19.0 BETTERMENT OF MARKS IN THE COURSES ALREADY PASSED

Students who clear all the courses in their first attempt and wish to improve their CGPA shall register and appear for betterment of marks for one course of any theory courses within a period of subsequent two semesters. The improved marks shall be considered for classification / distinction but not for ranking. If there is no improvement, there shall not be any change in the original marks already awarded.

20.0 AWARD OF DEGREE

20.1 Classification of degree will be as follows:

CGPA $\geq$ 7.5	CGPA $\geq$ 6.5 and < 7.5	CGPA $\geq$ 5.0 and < 6.5	CGPA $\geq$ 4.0 and < 5.0	CGPA < 4.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

20.2. In order to extend the benefit to the students with one/two backlogs after either VI semester or VIII semester, GRAFTING option is provided to the students enabling their placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:

a. Grafting will be done among the courses within the semester shall draw a maximum of 7 marks from the any one of the cleared courses in the semester and will be grafted to the failed course in the same semester.

b. Students shall be given a choice of grafting only once in the 4 years program, either after VI semester (Option #1) or after VIII semester (Option #2).

c. Option#1: Applicable to students who have maximum of TWO theory courses in V and / or VI semesters.

Option#2: Applicable to students who have maximum of TWO theory courses in VII and / or VIII semesters.

d. Eligibility for grafting:

i. Prior to the conduct of the supplementary examination after the declaration of VI or VIII semester results.

ii. S/he must appear in all regular or supplementary examinations as per the provisions laid down in regulations for the courses s/he appeals for grafting.

iii. The marks obtained by her/him in latest attempt shall be taken into account for grafting of marks in the failed course(s).

20.3 Student, who clears all the courses upto VII semester, shall have a chance to appear for Quick Supplementary Examination to clear the failed courses of VIII semester.

20.4 By the end of VI semester, all the students (regular and lateral entry students) shall complete one of the audit course and mandatory course with acceptable performance.

20.5 In case, a student takes more than one attempt in clearing a course, the final marks secured shall be indicated by * mark in the grade sheet.

All the candidates who register for the semester end examination will be issued grade sheet by the institute. Apart from the semester wise grade sheet, the institute will issue the provisional certificate and consolidated grade sheet subject to the fulfillment of all the academic requirements.

21.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

21.1 A candidate is normally not permitted to break the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the program in a later respective semester, s/he shall apply to the Principal in advance. Such application shall be submitted before the last date for payment of examination fee of the semester in question and forwarded through the Head of the department stating the reasons for such withdrawal together with supporting documents and endorsement of his / her parent / guardian.

21.2 The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to temporarily withdraw from the program. Such permission is accorded only to those who do not have any outstanding dues / demand at the College / University level including tuition fees, any other fees, library materials etc.

21.3 The candidate has to rejoin the program after the break from the commencement of the respective semester as and when it is offered.

21.4 The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in clause 18.0. The maximum period includes the break period.

21.5 If any candidate is detained for any reason, the period of detention shall not be considered as ‘Break of Study’.

22.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student is asked to leave the institute in the following circumstances:

a. The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b. A student shall not be permitted to study any semester more than three times during the entire Program of study.

c. The student fails to satisfy the norms of discipline specified by the institute from time to time.

23.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the institute / if any case of indiscipline / malpractice is pending against him, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

24.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute. The college shall institute prizes and medals to meritorious students and award them annually at the Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

25.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

26.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

27.0 TRANSITORY REGULATIONS

A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

a) Four Year B.Tech Regular course:

A student who is following Jawaharlal Nehru Technological University (JNTUH) curriculum and detained due to shortage of attendance at the end of the first semester shall join the autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUH curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

b) Three Year B.Tech program under Lateral Entry Scheme:

A student who is following JNTUH curriculum and detained due to shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUH curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

c) Transfer candidates (from non-autonomous college affiliated to JNTUH):

A student who is following JNTUH curriculum, transferred from other college to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in their place as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

d) Transfer candidates (from an autonomous college affiliated to JNTUH):

A student who has secured the required credits upto previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

28.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

MECHANICAL ENGINEERING

COURSE STRUCTURE

I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
AHS001	English for Communication	HS	Foundation	3	-	-	3	30	70	100
AHS002	Linear Algebra and Ordinary Differential Equations	BS	Foundation	3	1	-	4	30	70	100
AHS005	Engineering Chemistry	BS	Foundation	3	-	-	3	30	70	100
AHS007	Applied Physics	BS	Foundation	3	1	-	4	30	70	100
AME001	Engineering Drawing	ES	Foundation	2	-	3	4	30	70	100
PRACTICAL										
AHS101	Communication Skills Laboratory	HS	Foundation	-	-	2	1	30	70	100
AHS103	Engineering Chemistry Laboratory	BS	Foundation	-	-	2	1	30	70	100
ACS113	IT Workshop	ES	Foundation	-	-	3	2	30	70	100
AME101	Basic Workshop	ES	Foundation	-	-	3	2	30	70	100
TOTAL				**14**	**02**	**13**	**24**	**270**	**630**	**900**

II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
AME002	Engineering Mechanics	ES	Foundation	3	1	-	4	30	70	100
AHS003	Computational Mathematics and Integral Calculus	BS	Foundation	3	1	-	4	30	70	100
AHS008	Modern Physics	BS	Foundation	3	1	-	4	30	70	100
AHS009	Environmental Studies	HS	Foundation	3	-	-	3	30	70	100
ACS001	Computer Programming	ES	Foundation	3	-	-	3	30	70	100
PRACTICAL										
AHS102	Computational Mathematics Laboratory	BS	Foundation	-	-	2	1	30	70	100
AHS105	Engineering Physics Laboratory	BS	Foundation	-	-	2	1	30	70	100
ACS101	Computer Programming Laboratory	ES	Foundation	-	-	3	2	30	70	100
AME102	Computer Aided Engineering Drawing Practice	ES	Foundation	-	-	3	2	30	70	100
TOTAL				**15**	**03**	**10**	**24**	**270**	**630**	**900**

III SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
AHS010	Probability and Statistics	BS	Foundation	3	1	-	4	30	70	100
AME003	Thermodynamics	ES	Core	3	1	-	4	30	70	100
AME004	Mechanics of Solids	ES	Foundation	3	1	-	4	30	70	100
AME005	Metallurgy and Material Science	ES	Core	3	-	-	3	30	70	100
AEE018	Basic Electrical and Electronics Engineering	ES	Foundation	3	1	-	4	30	70	100
AHS017	Gender Sensitivity	MC	Perspective	-	-	-	-	-	-	-
PRACTICAL										
AME104	Metallurgy and Mechanics of Solids Laboratory	PC	Core	-	-	3	2	30	70	100
AME105	Machine Drawing through CAD Laboratory	PC	Core	-	-	3	2	30	70	100
AEE103	Basic Electrical and Electronics Engineering Laboratory	ES	Core	-	-	3	2	30	70	100
TOTAL				**15**	**04**	**09**	**25**	**240**	**560**	**800**

IV SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
AHS011	Mathematical Transforms Techniques	BS	Core	3	1	-	4	30	70	100
AME006	Production Technology	PC	Core	3	-	-	3	30	70	100
AME007	Applied Thermodynamics	PC	Core	3	1	-	4	30	70	100
AME008	Mechanics of Fluids and Hydraulic Machines	PC	Foundation	3	1	-	4	30	70	100
AME009	Kinematics of Machinery	PC	Foundation	3	1	-	4	30	70	100
	Audit Course	AC	Perspective	-	-	-	-	-	-	-
PRACTICAL										
AME106	Computational Mechanical Engineering Laboratory	PC	Core	-	-	3	2	30	70	100
AME107	Production Technology Laboratory	PC	Core	-	-	3	2	30	70	100
AME108	Mechanics of Fluids and Hydraulic Machines Laboratory	ES	Core	-	-	3	2	30	70	100
TOTAL				**15**	**04**	**09**	**25**	**240**	**560**	**800**

V SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
AME010	Machine Tools and Metrology	PC	Foundation	3	-	-	3	30	70	100
AME011	Dynamics of Machinery	PC	Core	3	1	-	4	30	70	100
AME012	Design of Machine Members	PC	Core	3	1	-	4	30	70	100
AME013	Thermal Engineering	PC	Core	3	-	-	3	30	70	100
AHS015	Business Economics and Financial Analysis	HS	Skill	3	-	-	3	30	70	100
	Professional Elective – I	PE	Elective	3	-	-	3	30	70	100
	Available and Selected MOOC Courses									
AHS106	Research and Content Development	HS	Skill	-	-	2	1	30	70	100
PRACTICAL										
AME109	Thermal Engineering Laboratory	PC	Core	-	-	3	2	30	70	100
AME110	Machine Tools and Metrology laboratory	PC	Core	-	-	3	2	30	70	100
TOTAL				**18**	**02**	**08**	**25**	**270**	**630**	**900**

VI SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
AME014	Finite Element Modeling	PC	Core	3	1	-	4	30	70	100
AME015	Machine Design	PC	Core	3	1	-	4	30	70	100
AME016	Heat Transfer	PC	Core	3	1	-	4	30	70	100
	Professional Elective - II	PE	Elective	3	-	-	3	30	70	100
	Available and Selected MOOC Courses									
	Open Elective – I	OE	Elective	3	1	-	3	30	70	100
	Available and Selected MOOC Courses									
	Value Added Course - I	AC	Skill	-	-	-	-	-	-	-
AME201	Ideation and Product Development	-	Skill	-	-	2	1	30	70	100
PRACTICAL										
AME111	Theory of Machines Laboratory	PC	Core	-	-	3	2	30	70	100
AME112	Heat Transfer Laboratory	PC	Core	-	-	3	2	30	70	100
AME113	Fluid, Thermal Modeling and Simulation Laboratory	PC	Core	-	-	3	2	30	70	100
TOTAL				**15**	**04**	**11**	**25**	**270**	**630**	**900**

VII SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week L	T	P	Credits	Scheme of Examination Max. Marks CIA	SEE	Total
THEORY										
AME017	Refrigeration and Air Conditioning	PC	Core	3	1	-	4	30	70	100
AME018	Computer Aided Design/Computer Aided Manufacturing	PC	Core	3	1	-	4	30	70	100
AME019	Instrumentation and Control Systems	PC	Core	3	1	-	4	30	70	100
	Professional Elective - III	PE	Elective	3	-	-	3	30	70	100
	Available and Selected MOOC Courses									
	Open Elective – II	OE	Elective	3	-	-	3	30	70	100
	Available and Selected MOOC Courses									
	Value Added Course - II	AC	Skill	-	-	-	-	-	-	-
PRACTICAL										
AME114	Computer Aided Modeling and Analysis Laboratory	PC	Core	-	-	3	2	30	70	100
AME115	Computer Aided Numerical Control Laboratory	PC	Core	-	-	3	2	30	70	100
AME116	Instrumentation and Control Systems Laboratory	PC	Core	-	-	3	2	30	70	100
AME301	Project Work (Phase- I)	PC	Core	-	-	-	-	-	-	-
TOTAL				**15**	**03**	**09**	**24**	**240**	**560**	**800**

VIII SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week L	T	P	Credits	Scheme of Examination Max. Marks CIA	SEE	Total
THEORY										
AME020	Automobile Engineering	PC	Core	3	-	-	3	30	70	100
AME021	Operations Research	PC	Core	3	-	-	3	30	70	100
	Professional Elective – IV	PE	Elective	3	-	-	3	30	70	100
	Available and Selected MOOC Courses									
PRACTICAL										
AME401	Comprehensive Examination	PC	Skill	-	-	-	1	-	100	100
AME302	Project Work (Phase- II)	PC	Core	-	-	4	10	30	70	100
TOTAL				**09**	**00**	**04**	**20**	**120**	**380**	**500**

PROFESSIONAL ELECTIVES

GROUP I: THERMAL ENGINEERING

Course Code	Course Title
AME501	Heating Ventilation and Air-Conditioning System
AME502	Gas Dynamics
AME503	Computational Fluid Dynamics
AME504	Renewable Energy Sources
AME505	Power Plant Engineering
AME506	Jet Propulsion and Rockets

GROUP II: MANUFACTURING

Course Code	Course Title
AME507	Unconventional Machining Processes
AME508	Computer Numerical Control Technology
AME509	Tool Design
AME510	Additive Manufacturing Techniques
AME511	Design Fabrication of Composites
AME512	Precision Engineering

GROUP- III: MATERIAL AND MANAGEMENT

Course Code	Course Title
AME513	Plant Layout and Material Handling
AME514	Management Information Systems
AME515	Nanomaterials
AME516	Engineering Optimization
AME517	Engineering Materials
AME518	Production Planning and Control

GROUP- IV: MACHINE DESIGN

Course Code	Course Title
AME519	Design of Hydraulic and Pneumatic Systems
AME520	Design for Manufacturing and Assembly
AME521	Design and Analysis of Composite Structures
AME522	Advanced Strength of Materials
AME523	Machine Dynamics
AME524	Mechanical Vibrations

GROUP- V: TESTING AND INTRUMENTATION

Course Code	Course Title
AME525	Solar Energy Systems
AME526	Non-Destructive Testing
AME527	Mechanical Measurements
AME528	Experimental Methods
AME529	Surface Engineering
AME530	Tribology

GROUP- VI: AUTOMATION

Course Code	Course Title
AME531	Mechatronics
AME532	Automation in Manufacturing
AME533	Robotics
AME534	Wind Tunnel Testing Techniques
AME535	Maintenance and Safety Engineering
AME536	Flexible Manufacturing System

OPEN ELECTIVE-I

Course Code	Course Title
AME551	Elements of Mechanical Engineering*
ACE551	Disaster Management
ACE552	Geospatial Techniques
ACS551	Principles of Operating System
ACS552	JAVA Programming
AEC551	Embedded System Design
AME552	Introduction to Automobile Engineering*
AME553	Introduction to Robotics*
AAE551	Aerospace Propulsion and Combustion
Note: * indicates that subject not offered to the students of Mechanical Engineering department.	

OPEN ELECTIVES- II

Course Code	Course Title
AEC552	Fundamentals of Image Processing
ACS553	Fundamentals of Database Management Systems
AIT551	Basics of Information Security and Cryptography
AHS551	Modeling and Simulation
AHS552	Research Methodologies
AEE551	Energy from Waste
AAE552	Finite Element Analysis
AME554	Basic Refrigeration and Air-Conditioning*
AAE553	Launch Vehicles and Controls*
Note: * indicates that subject not offered to the students of Mechanical Engineering department.	

AUDIT COURSES

Course Code	Course Title
AHS601	Intellectual Property Rights
AHS602	Total Quality Management
AHS603	Professional Ethics and Human Values
AHS604	Legal Sciences
AHS605	Clinical Psychology
AHS606	English for Special Purposes
AHS607	Entrepreneurship
AHS608	Any Foreign Language
AHS609	Design History
AHS017	Gender Sensitivity

VALUE ADDED COURSES - I

Course Code	Course Title
AME801	Cnc Turning Part Programming
AME802	Cnc Milling Part Programming
AME803	Industrial Engineering
AME804	3d Printing Technology

VALUE ADDED COURSES - II

Course Code	Course Title
AME805	Energy Conservation and Management
AME806	Lubrication Engineering
AME807	Principles of Material Selection
AME808	Advanced Welding Technology

SYLLABUS
(Semesters: I-VIII)

ENGLISH FOR COMMUNICATION

I Semester: AE / CE / ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS001	Foundation	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Communicate in an intelligible English accent and pronunciation.
II. Effectively use the four language skills i.e., Listening, Speaking, Reading and Writing.
III. Develop the art of writing simple English with correct spelling, grammar and punctuation.

UNIT-I LISTENING SKILL — Classes: 08

Significance, essentials, barriers and effectiveness of listening; Listening to dialogues, conversation, discussions, monologues; Listening to sounds, silent letters, stressed syllables in English; Listening for the gist of the text, for identifying the topic, general meaning and specific information; Listening for multiple choice questions, positive and negative comments for interpretation

Note: Instructions in theory and practice in the lab

UNIT-II SPEAKING SKILL — Classes: 10

Significance, essentials, barriers and effectiveness of speaking; Simple oral or casual interaction, dialogue, conversation; Debates: Differences between disagreeing and being disagreeable; Brief presentations; Role plays; Generating talks based on visual or written prompts; Addressing a small group or a large formal gathering; Speaking about present, past experiences and future plans; Arguing outs a topic without verbal fights; Paper presentation.

Note: Instructions in theory and practice in the lab

UNIT-III READING SKILL — Classes: 09

Techniques of reading: Skimming, scanning, intensive and extensive reading; Reading comprehension: Exercises for multiple choice questions and contextual meaning – Values in Dr. Kalam.

Vocabulary enrichment and grammar exercises based on selective readings: Swami Vivekananda: Chicago Speech, 1893; Passages for intellectual and emotional comments; Reading for the gist of a text, for specific information, for information transfer and interpretation.

UNIT-IV WRITING SKILL — Classes: 08

Significance, essentials and effectiveness of writing; Writing emails; Writing paragraphs: Comparing, contrasting, presentations with an introduction, body and conclusion; Writing formal and informal letters: Letter of invitation, accepting, declining, requesting, complaint, seeking information ; Cover letter enclosing a CV.

UNIT-V	VOCABULARY AND GRAMMAR	Classes: 10

Punctuation, parts of speech, articles, prepositions, tenses, concords, phrasal verbs; Forms of verbs: Regular and irregular, direct and indirect speech, change of voice; prefixes, suffixes, Synonyms, antonyms, one word substitutes, idioms and phrases, technical vocabulary.

Text Books:

1. Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles Practices", Oxford University Press, New Delhi, 3rd Edition , 2015.

Reference Books:

1. Norman Whitby, "Business Benchmark: Pre-Intermediate to Intermediate – BEC Preliminary", Cambridge University Press, 2nd Edition, 2008.
2. Devaki Reddy, Shreesh Chaudhary, "Technical English", Macmillan, 1st Edition, 2009.
3. Rutherford, Andrea J, "Basic Communication Skills for Technology", Pearson Education, 2nd Edition, 2010
4. Raymond Murphy, "Essential English Grammar with Answers" Cambridge University Press, 2nd Edition.

Web References:

1. http://www.edufind.com
2. http://www.myenglishpages.com
3. http://www.grammar.ccc.comment.edu
4. http://www.owl.english.prudue.edu

E-Text Books:

1. http://www.bookboon.com/en/communication-ebooks-zip
2. http://www.bloomsbury-international.com/images/ezone/ebook/writing-skills-pdf.pdf
3. https://www.americanenglish.state.gov/files/ae/resource_files/developing_writing.pdf
4. http://www.learningenglishvocabularygrammar.com/files/idiomsandphraseswithmeaningsandexamples pdf.pdf
5. http://www.robinwood.com/Democracy/GeneralEssays/CriticalThinking.pdf

Course Home Page:

LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

I Semester: Common for all Branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS002	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Analyze and solve linear system of equations by using elementary transformations.
II. Apply differential equations on real time applications
III. Determine the maxima and minima of functions of several variables by using partial differential coefficients.

UNIT-I	THEORY OF MATRICES	Classes: 08

Real matrices: Symmetric, skew-symmetric and orthogonal matrices; Complex matrices: Hermitian, Skew-Hermitian and unitary matrices; Elementary row and column transformations, elementary matrix, finding rank of a matrix by reducing to Echelon form and normal form; Finding the inverse of a matrix using elementary row/column transformations: Gauss-Jordan method; Solving of linear system of equations by LU decomposition method.

UNIT-II	LINEAR TRANSFORMATIONS	Classes: 10

Cayley-Hamilton theorem: Statement, verification, finding inverse and powers of a matrix; Linear dependence and independence of vectors; Linear transformation; Eigen values and Eigen vectors of a matrix; Properties of Eigen values and Eigen vectors of real and complex matrices; Diagonalization of matrix.

UNIT-III	DIFFERENTIAL EQUATIONS OF FIRST ORDER AND THEIR APPLICATIONS	Classes: 08

Solution of first order linear differential equations by exact, non exact, linear equations; Bernoulli equation.

Applications of first order differential equations: Orthogonal trajectories; Newton’s law of cooling; Law of natural growth and decay.

UNIT-IV	HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS	Classes: 10

Linear differential equations of second and higher order with constant coefficients, non-homogeneous term of the type $f(x)=e^{ax}, \sin ax, \cos ax$ and $f(x)=x^n, e^{ax}v(x), x^n v(x)$; Method of variation of parameters; Applications to electrical circuits and simple harmonic motion.

UNIT-V	FUNCTIONS OF SINGLE AND SEVERAL VARIABLES	Classes: 09

Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof; Functions of several variables: Partial differentiation, chain rule, total derivative, Euler's theorem, functional dependence, Jacobian, maxima and minima of functions of two variables without constraints and with constraints; Method of Lagrange multipliers.

Text Books:

1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2013.

Reference Books:

1. R K Jain, S R K Iyengar, "Advanced Engineering Mathematics", Narosa Publishers, 5th Edition, 2016.
2. Ravish R Singh, Mukul Bhatt, "Engineering Mathematics-1", Tata McGraw-Hill Education, 1st Edition, 2009.
3. Srimanthapal, Suboth C. Bhunia, "Engineering Mathematics", Oxford Publishers, 3rd Edition, 2015.

Web References:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resources/#Mathematics
3. http://www.sosmath.com/
4. http://www.mathworld.wolfram.com/

E-Text Books:

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re

Course Home Page:

ENGINEERING CHEMISTRY

I Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS005	Foundation	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Apply the electrochemical principles in batteries.
II. Understand the fundamentals of corrosion and development of different techniques in corrosion control.
III. Analysis of water for its various parameters and its significance in industrial applications.
IV. Improve the fundamental science and engineering principles relevant to materials.

UNIT-I	ELECTROCHEMISTRY AND BATTERIES	Classes: 10

Electrochemistry: Basic concepts of electrochemistry; Conductance: Specific, equivalent and molar conductance and effect of dilution on conductance; Electrochemical cells: Galvanic cell (daniel cell); Electrode potential; Electrochemical series and its applications; Nernst equation; Types of electrodes: Calomel electrode, quinhydrone electrode; Batteries: Classification of batteries, primary cells (dry cells) and secondary cells (lead-acid battery, Ni-Cd cell), applications of batteries, numerical problems.

UNIT-II	CORROSION AND ITS CONTROL	Classes: 08

Corrosion: Introduction, causes and effects of corrosion; Theories of corrosion: Chemical and electrochemical corrosion with mechanism; Factors affecting the rate of corrosion: Nature of the metal and nature of the environment; Types of corrosion: Waterline and crevice corrosion; Corrosion control methods: Cathodic protection- sacrificial anodic protection and impressed current cathodic protection; Surface coatings: Metallic coatings, methods of application of metallic coatings-hot dipping(galvanizing, tinning), electroplating(copper plating); Organic coatings: Paints, its constituents and their functions.

UNIT-III	WATER TECHNOLOGY	Classes: 09

Water: Sources and impurities of water, hardness of water, expression of hardness-units; Types of hardness: Temporary hardness, permanent hardness and numerical problems; Estimation of temporary and permanent hardness of water by EDTA method; Determination of dissolved oxygen by Winkler's method; Boiler troubles: Priming, foaming, scales, sludges and caustic embrittlement.

Treatment of water: Internal treatment of boiler feed water- carbonate, calgon and phosphate conditioning, softening of water by Zeolite process and Ion exchange process; Potable water-its specifications, steps involved in the treatment of potable water, sterilization of potable water by chlorination and ozonization, purification of water by reverse osmosis process.

UNIT-IV	MATERIALS CHEMISTRY	Classes: 10

Materials chemistry: Polymers-classification with examples, polymerization-addition, condensation and co-polymerization; Plastics: Thermoplastics and thermosetting plastics; Compounding of plastics; Preparation, properties and applications of polyvinyl chloride, Teflon, Bakelite and Nylon-6, 6; Rubbers: Natural rubber its process and vulcanization; Elastomers: Buna-s and Thiokol rubber; Fibers: Characteristics of fibers, preparation properties and applications of Dacron; Characteristics of fiber reinforced plastics; Cement: Composition of Portland cement, setting and hardening of Portland cement; Lubricants: Classification with examples; Properties: Viscosity, flash, fire, cloud and pour point; Refractories: Characteristics and classification with examples.

UNIT-V	**FUELS AND COMBUSTION**	**Classes: 08**

Fuel: Definition, classification of fuels and characteristics of a good fuels; Solid fuels: Coal; Analysis of coal: Proximate and ultimate analysis; Liquid fuels: Petroleum and its refining; Cracking: Fixed bed catalytic cracking; Knocking: Octane and cetane numbers; Gaseous fuels: Composition, characteristics and applications of natural gas, LPG and CNG; Combustion: Calorific value: Gross Calorific Value(GCV) and Net Calorific Value(NCV), calculation of air quantity required for complete combustion of fuel, numerical problems.

Text Books:

1. P. C. Jain, Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 15^{th} Edition, 2015.
2. Shasi Chawla, "Text Book of Engineering Chemistry", Dhantpat Rai Publishing Company, New Delhi, 1^{st} Edition, 2011.

Reference Books:

1. B. Siva Shankar, "Engineering Chemistry", Tata McGraw-Hill Publishing Limited, 3^{rd} Edition, 2015.
2. S. S. Dara, Mukkanti, "Text of Engineering Chemistry", S. Chand & Co., New Delhi, 12^{th} Edition, 2006.
3. C. V. Agarwal, C. P. Murthy, A. Naidu, "Chemistry of Engineering Materials", Wiley India, 5^{th} Edition, 2013.
4. R. P. Mani, K. N. Mishra, "Chemistry of Engineering Materials", Cengage Learning, 3^{rd} Edition, 2015.

Web References:

1. https://www.tndte.com
2. https://www.nptel.ac.in/downloads
3. https://www.scribd.com
4. https://www.cuiet.info
5. https://www.sbtebihar.gov.in
6. https://www.ritchennai.org

E-Text Books:

1. https://www.Corrosion.ksc.nasa.gov/electrochem_cells.htm
2. https://www.science.uwaterloo.ca/~cchieh/cact/applychem/watertreatment.html
3. https://www.acs.org/content/acs/en/careers/college-to-career/areas-of-chemistry/polymer-chemistry.html
4. https://www.darvill.clara.net/altenerg/fossil.htm
5. https://www.Library.njit.edu/research helpdesk/subject guides/chemistry.php

Course Home Page:

APPLIED PHYSICS

I Semester: AE / CE / ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS007	Foundation	3	1	-	4	30	70	100
Contact Classes:45	Tutorial Classes:15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Develop the strong fundamentals of system of forces and friction.

II. Strengthen the knowledge of theoretical and technological aspects of dynamics of rigid bodies.

III. Correlate the principles with applications of the dielectric and magnetic materials.

IV. Enrich the knowledge in acoustics and ultrasonics.

UNIT-I	DIELECTRIC AND MAGNETIC PROPERTIES	Classes: 09

Dielectric Properties: Basic definitions, electronic, ionic and orientation polarizations-qualitative; Internal field in solids; Magnetic properties: Basic definitions, origin of magnetic moment, Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, domain theory of ferro magnetism on the basis of hysteresis curve.

UNIT-II	ACOUSTICS AND ULTRASONICS	Classes: 09

Acoustics: Reverberation, reverberation time, Sabine's formula (qualitative), absorption coefficient, measurement of absorption coefficient, factors affecting acoustics of an auditorium and their remedies; Ultrasonics: Introduction; Generation of ultrasonic waves; Magnetostriction method, piezoelectric method, properties, applications.

UNIT-III	EQUILIBRIUM OF SYSTEM OF FORCES	Classes: 09

Introduction, basic concepts, system of forces, coplanar concurrent forces, force systems in plane, parallel forces in plane.

Force systems in space, couples, resultant, Lami's theorem, triangle law of forces, polygon law of forces, condition of equilibrium.

UNIT-IV	FRICTION	Classes: 09

Friction: Types of friction, limiting friction, laws of friction, angle of repose, equilibrium of body laying on rough inclined plane, application of friction, ladder friction, wedge friction, screw friction.

UNIT-V	DYNAMICS OF RIGID BODIES - MOMENT OF INERTIA	Classes: 09

Rotational motion, torque, angular momentum, relation between torque and angular momentum, angular momentum of system of particles, moment of inertia, expression for moment of inertia, radius of gyration, theorems on moment of inertia, moment of inertia of thin rod, rectangular lamina, circular disc.

Text Books:

1. Dr. K. Vijaya Kumar, Dr. S Chandralingam, “Modern Engineering Physics”, S. Chand & Co, New Delhi, 1st Edition, 2010.
2. R. C Hibbler, "Engineering mechanics", Prentice Hall, 12th Edition, 2009.

Reference Books:
1. R. K. Gaur, S. L. Gupta, “Engineering Physics”, Dhanpat Rai Publications, 8^{th} Edition, 2001. 2. Timoshenko, D. H. Young, "Engineering Mechanics", Tata McGraw-Hill, 5^{th} Edition, 2013. 3. Hitendra K Malik, A. K. Singh, “Engineering Physics”, McGraw-Hill Education, 1^{st} Edition, 2009. 4. S. S. Bhavikatti, "A text book of Engineering Mechanics", New age international, 1^{st} Edition, 2012.
Web References:
1. http://www.link.springer.com 2. http://www.intechopen.com 3. http://www.iitg.ernet.in/rkbc/me101/Presentation/L01-03.pdf 4. http://www.vssut.ac.in/lecture_notes/lecture1423904717.pdf
E-Text Books:
1. http://www.peaceone.net/basic/Feynman/ 2. http://www.physicsdatabase.com/free-physics-books/ 3. http://www.freeengineeringbooks.com/Civil/Engineering-Mechanics-Books.php 4. http://www.textbooksonline.tn.nic.in/books/11/stdxi-voc-ema-em-2.pdf
Course Home Page:

ENGINEERING DRAWING

I Semester: AE / CE / ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME001	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	-	3	4	30	70	100
Contact Classes: 30	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 75**		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic principles of engineering drawing and construction of curves used in engineering field.
II. Apply the knowledge of interpretation of projection in different quadrants.
III. Understand the projections of solids, when it is inclined to both planes simultaneously.
IV. Convert the pictorial views into orthographic view and vice versa.
V. Create intricate details of components through sections and develop its surfaces.

UNIT-I	FUNDAMENTALS OF ENGINEERING DRAWING, SCALES AND CURVES	Classes: 09

Introduction to engineering drawing: Drawing instruments and accessories, types of line, lettering practice and rules of dimensioning, geometrical constructions, basic geometrical shapes; Scales: Types of scales, units of length and their conversion, construction of scales, plain scale, diagonal scale, vernier scale; Curves used in engineering practice and their constructions; Conic sections, construction of ellipse parabola and hyperbola, special curves, construction of cycloid, epicycloids, hypocycloid and involutes.

UNIT-II	ORTHOGRAPHIC PROJECTION, PROJECTION OF PLANES	Classes: 09

Orthographic projection: Principles of orthographic projections, conventions, first and third angle projections, projection of points, projection of lines, lines inclined to single plane, lines inclined to both the planes, true lengths and traces; Projection of planes: Projection of regular planes, planes inclined to one plane, planes inclined to both planes, projection of planes by auxiliary plane projection method.

UNIT-III	PROJECTION OF SOLIDS	Classes: 09

Projection of solids: Projections of regular solid, prisms, cylinders, pyramids, cones.

Solids inclined to one plane, solids inclined to both planes, projection of solid by auxiliary plane projection method.

UNIT-IV	DEVELOPMENT OF SURFACES, ISOMETRIC PROJECTIONS	Classes: 09

Development of surfaces: Development of lateral surface of right regular solids, prisms, cylinders, pyramids and cones; Isometric projections: Principle of isometric projection, isometric scale, isometric projections and isometric views, isometric projections of planes, prisms, cylinders, pyramids, and cones.

UNIT-V	TRANSFORMATION OF PROJECTIONS	Classes: 09

Transformation of projections: Conversion of isometric views to orthographic views and conversion of orthographic views to isometric views.

Text Books:
1. N. D. Bhatt, "Engineering Drawing", Charotar Publications, 49th Edition, 2012. 2. C. M. Agrawal, Basant Agrawal, "Engineering Drawing'', Tata McGraw-Hill, 2nd Edition, 2013.
Reference Books:
1. K. Venugopal, "Engineering Drawing and Graphics", New Age Publications, 2nd Edition, 2010. 2. Dhananjay. A. Johle, "Engineering Drawing", Tata McGraw-Hill, 1st Edition, 2008. 3. K. C. John, "Engineering Drawing", PHI Learning Private Limited", 2nd Edition, 2009.
Web References:
1. https://nptel.ac.in/courses/112103019/ 2. https://nptel.ac.in/courses/112103019/14
E-Text Books:
1. https://books.google.co.in/books/about/Engineering_Drawing.html?id=_hdOU8kRb2AC
Course Home Page:

COMMUNICATION SKILLS LABORATORY

I Semester: AE / CE / ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS101	Foundation	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The course enables the students to:

I. Improve their ability to listen and comprehend a given text.
II. Upgrade the fluency and acquire a functional knowledge of English Language.
III. Enrich thought process by viewing a problem through multiple angles.

LIST OF EXPERIMENTS

Week-l LISTENING SKILL

a. Listening to conversations and interviews of famous personalities in various fields, listening practice related to the TV talk shows, news.
b. Listening for specific information, listening for summarizing information.

Week-2 LISTENING SKILL

a. Listening to films of short duration and monologues for taking notes, listening to answer multiple choice questions.
b. Listening to telephonic conversations; Listening to native Indian, British and American speakers to analyze intercultural differences.

Week-3 SPEAKING SKILL

a. Functions of English Language; Introduction to phonetics, exercises on pronunciation, symbols of phonetics.
b. Speaking exercises involving the use of stress and intonation, improving pronunciation through tongue twisters.
c. Tips on how to develop fluency, body language and communication; Introducing oneself: Talking about yourself others, leave taking.

Week-4 SPEAKING SKILL

a. Just a minute (JAM) sessions, public speaking, situational conversation/role-play.
b. Greetings for different occasions with feedback preferably through video recording; Speaking about present, past experiences and future plans; Acting as a compere and news reader.

Week-5 READING SKILL

a. Reading anecdotes to predict the content, reading for interpretation.
b. Suggested reading: Short stories and poem; Critical reading.

Week-6	**READING SKILL**
a. Reading for information transfer; Reading newspaper and magazine articles, memos, letters, notices and minutes for critical commentary. b. Reading selective autobiographies.	
Week-7	**READING SKILL**
a. Reading brochures, advertisements, pamphlets for improved presentation. b. Reading comprehension exercises with critical and analytical questions based on context.	
Week-8	**WRITING SKILL**
a. Writing messages, leaflets, notice; Writing tasks; Flashcard. b. Filling gaps while listening short stories.	
Week-9	**WRITING SKILL**
a. Write a slogan related to the image. b. Write a short story of 6-10 lines based on the hints given.	
Week-10	**WRITING SKILL**
a. Writing a short story on their own; Writing a review on: Video clippings on inspirational speeches. b. Writing a review on short films, advertisements, recipe and recently watched film.	
Week-11	**THINKING SKILL**
a. Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms, proverbs. b. Argumentative skills; Debates.	
Week-12	**THINKING SKILL**
a. Inculcating interest in English using thinking blocks. b. Making pictures and improvising diagrams to form English words, phrases and proverbs.	
Reference Books:	
1. Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles Practices", Oxford University Press, New Delhi, 3rd Edition, 2015. 2. Rhirdion, Daniel, "Technical Communication", Cengage Learning, New Delhi, 1st Edition, 2009.	
Web References:	
1. http://learnenglish.britishcouncil.org 2. http://www.esl-lab.com/ 3. http://www.elllo.org/	
Course Home Page:	

ENGINEERING CHEMISTRY LABORATORY

I Semester: AE / CE / ME								
Course Code	Category	Hours / Week			Credit	Maximum Marks		
AHS103	Foundation	L	T	P	C	CIA	SEE	Total
		-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 28				Total Classes: 28		

OBJECTIVES:

The course should enable the students to:

I. Comprehend the experimental results.
II. Analyze, interpret, and draw conclusions from data.

LIST OF EXPERIMENTS

Week-l	INTRODUCTION TO CHEMISTRY LABORATORY
Introduction to chemistry laboratory. Do's and Don'ts in chemistry laboratory.	
Week-2	**VOLUMETRIC ANALYSIS**
Batch I: Estimation of hardness of water by EDTA method. Batch II: Estimation of dissolved oxygen in water.	
Week-3	**VOLUMETRIC ANALYSIS**
Batch I: Estimation of dissolved oxygen in water Batch II: Estimation of hardness of water by EDTA method	
Week-4	**VOLUMETRIC ANALYSIS**
Batch I: Estimation of Mno_2 in pyrolusite. Batch II: Determination of copper in brass.	
Week-5	**VOLUMETRIC ANALYSIS**
Batch I: Determination of copper in brass Batch II: Estimation of Mno_2 in pyrolusite	
Week-6	**INSTRUMENTATION**
Batch I: Conductometric titration of strong acid vs strong base. Batch II: Potentiometric titration of strong acid vs strong base.	
Week-7	**INSTRUMENTATION**
Batch I: Potentiometric titration of strong acid vs strong base. Batch II: Conductometric titration of strong acid vs strong base.	

Week-8	INSTRUMENTATION
Batch I: Conductometric titration of mixture of acids vs strong base. Batch II: Potentiometric titration of weak acid vs strong base.	
Week-9	**INSTRUMENTATION**
Batch I: Potentiometric titration of weak acid vs strong base. Batch II: Conductometric titration of mixture of acids vs strong base.	
Week-10	**PHYSICAL PROPERTIES**
Batch I: Determination of viscosity of sample oil by Redwood / Oswald's viscometer. Batch II: Determination of surface tension of lubricants	
Week-11	**PHYSICAL PROPERTIES**
Batch I: Determination of surface tension of lubricants. Batch II: Determination of viscosity of sample oil by Redwood / Oswald's viscometer.	
Week-12	**PREPARATION OF ORGANIC COMPOUNDS**
Batch I: Preparation of Aspirin. Batch II: Preparation of Thiokol rubber.	
Week-13	**PREPARATION OF ORGANIC COMPOUNDS**
Batch I: Preparation of Thiokol rubber Batch II: Preparation of Aspirin	
Week-14	**REVISION**
Revision.	
Reference Books:	
1. Vogel's, "Quantitative Chemical Analaysis", Prentice Hall, 6th Edition, 2000. 2. Gary D.Christian, "Analytical Chemistry", Wiley India, 6th Edition, 2007.	
Web References:	
http://www.iare.ac.in	

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS:

S. No	Name of the Apparatus	Apparatus Required	Quantity
1	Analytical balance	04	100 gm
2	Beaker	30	100 ml
3	Burette	30	50 ml
4	Burette Stand	30	Metal
5	Clamps with Boss heads	30	Metal
6	Conical Flask	30	250 ml
7	Conductivity cell	10	K=1
8	Calomel electrode	10	Glass
9	Digital Potentiometer	10	EI
10	Digital Conductivity meter	10	EI
11	Digital electronic balance	01	RI
12	Distilled water bottle	30	500 ml
13	Funnel	30	Small
14	Glass rods	30	20 cm length
15	Measuring Cylinders	10	10 ml
16	Oswald Viscometer	30	Glass
17	Pipette	30	20 ml
18	Platinum Electrode	10	PP
19	Porcelain Tiles	30	White
20	Reagent bottle	30	250 ml
21	Standard Flask	30	100 ml
22	Stalagmo meter	30	Glass

IT WORKSHOP

I Semester: AE / CE / ME								
Course Code	Category	Hours / Week			Credit	Maximum Marks		
ACS113	Foundation	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Provide technical training to the students on productivity tools like word processors, spreadsheets, presentations.

II. Make the students know about the internal parts of a computer.

III. Learn about networking of computers and use internet facility for browsing and searching.

LIST OF EXPERIMENTS

Week	Topic
Week-1	**NETWORK CONNECTIONS**
IP configurations, connecting devices in LAN through bridge, hub, switch. Wi-Fi, Li-Fi and bluetooth settings; Crimping: Crossover, strait over.	
Week-2	**TROUBLESHOOTING**
Hardware troubleshooting, software troubleshooting.	
Week-3	**BLOG CREATION**
Creating blogs import the data into blogs, blog templates, and blog design.	
Week-4	**SKYPE INSTALLATION**
Skype installation and usages of Skype.	
Week-5	**CYBER HYGIENE**
Install Antivirus software; Configure their personal firewall and windows update on their computer.	
Week-6	**MS WORD**
Basic text editing, text formatting, paragraph formatting, style formatting, page formatting.	
Week-7	**MS WORD**
Working with graphics and pictures, tables, mail merge, customizing and expanding word.	
Week-8	**MS EXCEL**
Introduction to working with cells, rows, and columns, introduction to formulas and calculations, working with formulas and functions; Formatting: Formatting data, cells, rows and columns; Editing: Cells, rows, columns and worksheets.	

Week-9	MS EXCEL
Maintaining worksheets, the what-if analysis, adding images and graphics, charts and diagrams, creating data lists, managing data, pivot tables and charts.	
Week-10	**MS POWER POINT**
PowerPoint screen, working with slides, add content, work with text, working with tables.	
Week-11	**MS POWER POINT**
Graphics, slide animation, reordering slides, adding sound to a presentation.	
Week-12	**MICROSOFT OUTLOOK**
Introduction to Microsoft Outlook: Navigating outlook, sending and receiving messages, formatting messages, adding tables and other elements to messages, inserting graphics and images into e-mails, working with messages, organizing mail, advanced mail features, address books and contacts, using the calendar, reminders, tasks, notes, social media and outlook, sharing.	

Reference Books:

1. Peter Norton, "Introduction to Computers", Tata McGraw-Hill Publishers, 6th Edition, 2010.
2. Scott Muller, Que, "Upgrading and Repairing", Pearson Education, PC's 18th Edition, 2009.

Web References:

1. http://www.cl.cam.ac.uk/teaching/1011/CompFunds
2. http://www.bibcol.com
3. http://www.tutorialspoint.com/computer_fundamentals
4. http://www.craftsmanspace.com

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: System Software: Linux / Windows 7.
Application Software's: MS Office and TeXworks 0.6.1on LaTeX 2e (Open Source)

HARDWARE: 30 numbers of Desktop Computer Systems

BASIC WORKSHOP

I Semester: AE / CE / ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME101	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Identify and use of tools, types of joints in carpentry, fitting, tin smithy and plumbing operations.
II. Understand of electrical wiring and components.
III. Observation of the function of lathe, shaper, drilling, boring, milling, grinding machines.

LIST OF EXPERIMENTS

Week-1	**CARPENTRY**
Batch I: Preparation of lap joint as per given dimensions. Batch II: Preparation of dove tail joint as per given taper angle.	
Week-2	**CARPENTRY**
Batch I: Preparation of dove tail joint as per given taper angle. Batch II: Preparation of lap joint as per given dimensions.	
Week-3	**FITTING**
Batch I: Make a square fit for given sizes. Batch II: Make a straight fit for given dimensions.	
Week-4	**FITTING**
Batch I: Make a straight fit for given dimensions. Batch II: Make a square fit for given sizes.	
Week-5	**TIN SMITHY**
Batch I: Prepare the development of a surface and make a round tin. Batch II: Prepare the development of a surface and make a rectangular tray.	
Week-6	**TIN SMITHY**
Batch I: Prepare the development of a surface and make a rectangular tray. Batch II: Prepare the development of a surface and make a round tin.	
Week-7	**FOUNDRY**
Batch I: Prepare a wheel flange mould using a given wooden pattern. Batch II: Prepare a bearing housing using a aluminum pattern.	

Week-8	**FOUNDRY**
Batch I: Prepare a bearing housing using a aluminum pattern. Batch II: Prepare a wheel flange mould using a given wooden pattern.	
Week-9	**HOUSE WIRING**
Batch I: Make an electrical connection to demonstrate domestic voltage and current sharing. Batch II: Make an electrical connection to control one bulb with two switches-stair case connection.	
Week-10	**HOUSE WIRING**
Batch I: Make an electrical connection to control one bulb with two switches-stair case connection. Batch II: Make an electrical connection to demonstrate domestic voltage and current sharing.	
Week-11	**BLACK SMITHY**
Batch I: Prepare S-bend for given MS rod using open hearth furnace. Batch II: Prepare J-bendof given MS rod using open hearth furnace	
Week-12	**BLACK SMITHY**
Batch I: Prepare J-bend of given MS rod using open hearth furnace. Batch II: Prepare S-bend for given MS rod using open hearth furnace.	
Week-13	**DEMONSTRATION OF WELDING AND PIPE PLUMBING JOINTS**
Batch I: Demonstration of arc welding and gas welding, Batch II: Preparation of pipe plumbing joints.	
Week-14	**DEMONSTRATION OF MACHINE TOOLS**
Batch I: Familiarization of central lathe and shaping machine and it's working. Batch II: Familiarization of drilling, milling and grinding machines and its working.	
Week-15	**DEMONSTRATION OF MACHINE TOOLS**
Batch I: Familiarization of drilling, milling and grinding machines and its working. Batch II: Familiarization of central lathe and shaping machine and it's working.	
Reference Books:	
1. K. C. John, "Mechanical Workshop Practice", PHI, 2nd Edition, 2010. 2. H.S. Bawa, "Workshop Practice", Tata McGraw-Hill Publishing Company Limited, 2nd Edition 2009. 3. S. K. Hajra Choudhury, A. K. Hajra Choudhury, "Elements of Workshop Technology", Media Promoters, 1st Edition, 2009.	
Web References:	
http://www.iare.ac.in	
Course Home Page:	

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS:

S.No	EQUIPMENT DESCRIPTION	QUANTITY
1.	Carpentry vice, fitting vice	8
2.	Standard wood Working tool.	8
3.	Models of carpentry, fitting, black smithy.	1
4.	Standard fitting working tool.	5
5.	Standard black smithy working tool.	1
6.	Standard electrical working tool	4
7.	Open hearth furnace.	1
8.	Arc welding transformer with cables and holders.	1
9.	Welding accessories like welding shield, chipping hammer, wire brush.	1
10.	Moulding table, foundry tools.	1
11	Furnace with blower.	1
12	Oxygen and acetylene gas cylinders, blow and other welding outfit.	1Each
13	Power tool cutter.	1

LIST OF CONSUMABLES REQUIRED FOR A BATCH OF 30 STUDENTS:

S. No	DESCRIPTION	QUANTITY
1	Standard wood piece 300x50x25 mm.	3
2	Standard mild steel Specimen 50x50x8 mm.	3
3	Mild steel rod 200x10 mm.	3
4	Galvanized sheet 180x70 mm.	8 sheets
5	Galvanized sheet 130x170 mm.	8 sheets
6	Electrical holders.	6
7	Electrical bubs 40W.	6
8	Electrical switches (Two way and single way)	6
9	Florescent tube light	2
10	Electrical wire insulated.	1 bundle 160 gauge
11	Moulding sand.	50 kg
12	Mild steel rod	50 meters
13	Mild steel flat	50 meters

ENGINEERING MECHANICS

II Semester: AE / CE / ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME002	Foundation	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes:45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Develop the ability to work comfortably with basic engineering mechanics concepts required for analyzing static structures.
II. Identify an appropriate structural system to studying a given problem and isolate it from its environment, model the problem using good free body diagrams and accurate equilibrium equations.
III. Identify and model various types of loading and support conditions that act on structural systems, apply pertinent mathematical, physical and engineering mechanical principles to the system to solve and analyze the problem.
IV. Solve the problem of equilibrium by using the principle of work and energy in mechanical design and structural analysis.
V. Apply the concepts of vibrations to the problems associated with dynamic behavior.

UNIT-I	KINEMATICS OF PARTICLES RECTILINEAR MOTION	Classes: 09

Kinematics of particles rectilinear motion: Motion of a particle**,** rectilinear motion**,** motion curves**,** rectangular components of curvilinear motion, kinematics of rigid body, types of rigid body motion, angular motion, fixed axis rotation**.**

UNIT-II	KINETICS OF PARTICLE	Classes: 09

Kinetics of particle: Introduction, definitions of matter, body, particle, mass, weight, inertia, momentum, Newton’s law of motion, relation between force and mass, motion of a particle in rectangular coordinates, D’Alembert’s principle, motion of lift, motion of body on an inclined plane, motion of connected bodies.

UNIT-III	IMPULSE AND MOMENTUM, VIRTUAL WORK	Classes: 09

Impulse and momentum: Introduction; Impact, momentum, impulse, impulsive forces, units, law of conservation of momentum, Newton’s law of collision of elastic bodies.

Coefficient of restitution, recoil of gun, impulse momentum equation; Virtual work: Introduction, principle of virtual work, applications, beams, lifting machines, simple framed structures.

UNIT-IV	WORK ENERGY METHOD	Classes: 09

Work energy method: Law of conservation of energy, application of work energy, method to particle motion and connected system, work energy applied to connected systems, work energy applied to fixed axis rotation.

UNIT-V	MECHANICAL VIBRATIONS	Classes: 09

Mechanical vibrations: Definitions and concepts, simple harmonic motion, free vibrations, simple and compound pendulum, torsion pendulum, free vibrations without damping, general cases.

Text Books:

1. R. C. Hibbler, "Engineering Mechanics", Prentice Hall, 12th Edition, 2009.
2. Timoshenko, D. H.Young, "Engineering Mechanics", Tata McGraw-Hill, 5th Edition, 2013.

Reference Books:

1. S. Bhavikatti, "A Text Book of Engineering Mechanics", New Age International, 1st Edition, 2012.
2. A. K. Tayal, "Engineering Mechanics", Uma Publications, 14th Edition, 2013.
3. R. K. Bansal "Engineering Mechanics", Laxmi Publication, 8th Edition, 2013.
4. BasudebBhattacharya, "EngineeringMechanics", Oxford UniversityPress, 2nd Edition, 2014.
5. K.Vijay Reddy, J. Suresh Kumar, "Singer's Engineering Mechanics Statics and Dynamics", B S Publishers, 1st Edition, 2013.

Web References:

1. https://en.wikipedia.org/wiki/Dynamics_(mechanics)
2. https://www.youtube.com/playlist?list=PLUl4u3cNGP62esZEwffjMAsEMW_YArxYC

E-Text Books:

1. http://www.freeengineeringbooks.com/Civil/Engineering-Mechanics-Books.php
2. http://www.textbooksonline.tn.nic.in/books/11/stdxi-voc-ema-em-2.pdf
3. http://www.faadooengineers.com/threads/17024-Engineering-mechanics-pdf-Free-Download

Course Home Page:

COMPUTATIONAL MATHEMATICS AND INTEGRAL CALCULUS

II Semester: **AE / CE / ME**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS003	Foundation	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	**Tutorial Classes:15**	**Practical Classes: Nil**				**Total Classes: 60**		

OBJECTIVES:

The course should enable the students to:

I. Enrich the knowledge of solving algebraic, transcendental and differential equation by numerical methods.
II. Apply multiple integration to evaluate mass, area and volume of the plane.
III. Analyze gradient, divergence and curl to evaluate the integration over a vector field.
IV. Understand the Bessels equation to solve them under special conditions with the help of series solutions.

UNIT-I	ROOT FINDING TECHNIQUES AND INTERPOLATION	Classes: 09

Root finding techniques: Solving algebraic and transcendental equations by bisection method, method of false position, Newton-Raphson method; Interpolation: Finite differences, forward differences, backward differences and central differences; Symbolic relations; Newton's forward interpolation, Newton's backward interpolation; Gauss forward central difference formula, Gauss backward central difference formula; Interpolation of unequal intervals: Lagrange's interpolation.

UNIT-II	CURVE FITTING AND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	Classes: 08

Fitting a straight line; Second degree curves; Exponential curve, power curve by method of least squares; Taylor's series method; Step by step methods: Euler's method, modified Euler's method and Runge-Kutta method for first order differential equations.

UNIT-III	MULTIPLE INTEGRALS	Classes: 10

Double and triple integrals; Change of order of integration.

Transformation of coordinate system; Finding the area of a region using double integration and volume of a region using triple integration.

UNIT-IV	VECTOR CALCULUS	Classes: 08

Scalar and vector point functions; Gradient, divergence, curl and their related properties; Solenoidal and irrotational vector point functions; Scalar potential function; Laplacian operator; Line integral, surface integral and volume integral; Vector integral theorems: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem without proofs.

UNIT-V	SPECIAL FUNCTIONS	Classes: 10

Gamma function, properties of gamma function; Ordinary point and regular singular point of differential equations; Series solutions to differential equations around zero, Frobenius method about zero; Bessel's differential equation: Bessel functions properties, recurrence relations, orthogonality, generating function, trigonometric expansions involving Bessel functions.

Text Books:

1. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.

Reference Books:

1. R K Jain, S R K Iyengar, "Advanced Engineering Mathematics", Narosa Publishers, 5th Edition, 2016.
2. S. S. Sastry, "Introduction Methods of Numerical Analysis", Prentice-Hall of India Private Limited, 5th Edition, 2012.

Web References:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resources/#Mathematics
3. http://www.sosmath.com/
4. http://www.mathworld.wolfram.com

E-Text Books:

1. http://www.keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktu-ebook-download.html
2. http://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks

Course Home Page:

MODERN PHYSICS

II Semester: **AE / CE / ME**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS008	Foundation	3	1	-	4	30	70	100
Contact Classes:45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Develop strong fundamentals of crystal structures and properties.
II. Meliorate the knowledge of theoretical and technological aspects of lasers and optical fibers.
III. Correlate principles with applications of the x-ray diffraction and defects in crystals.
IV. Enrich knowledge in modern engineering principles of interference and diffraction.

UNIT-I	CRYSTALLOGRAPHY AND CRYSTAL STRUCTURES	Classes: 09

Crystallography and crystal structures: Space lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, directions and planes in crystals, Miller indices, interplanar spacing of orthogonal crystal systems, atomic radius, coordination number and packing factor of SC, BCC, FCC, NaCl and diamond structures.

UNIT-II	X-RAY DIFFRACTION AND DEFECTS IN CRYSTALS	Classes: 09

X-ray diffraction: Bragg's law, Laue method, powder method and applications; Defects in crystals: Concepts of point defects, vacancies, substitutional, interstitial, frenkel, schottky defects, line defects and Burger's vector.

UNIT-III	LASERS AND SENSORS	Classes: 09

Lasers: Characteristics of lasers, spontaneous and stimulated emission of radiation, metastable state, population inversion, lasing action, ruby laser, semiconductor diode laser and applications of lasers.

Sensors: Introduction, basic principles, sensor materials and applications: principle of pressure, optical, acoustic and thermal sensing.

UNIT-IV	FIBER OPTICS	Classes: 09

Fiber optics: Principle and construction of an optical fiber, acceptance angle, numerical aperture, types of optical fibers (Single mode, multimode, step index, graded index), attenuation in optical fibers, application of optical fibers and optical fiber communication system with block diagram.

UNIT-V	INTERFERENCE AND DIFFRACTION	Classes: 09

Interference: Phase difference, path difference, coherence, conditions for constructive and destructive interference, interference in thin films due to reflected light, Newton rings experiment. Diffraction: Introduction, differences between interference and diffraction, types of diffraction, Fraunhofer diffraction due to single slit, N-slits, diffraction grating experiment.

Text Books:

1. Dr. K. Vijaya Kumar, Dr. S. Chandralingam, "Modern Engineering Physics", S. Chand & Co. New Delhi, 1st Edition, 2010.

2. Rajendran, "Engineering Physics", Tata McGraw-Hill Book Publishers, 1st Edition, 2010.
Reference Books:
1. P. K. Palanisamy, "Engineering Physics", Scitech Publishers, 4th Edition, 2014. 2. R. K. Gaur, S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 8th Edition, 2001. 3. A. J. Dekker, "Solid State Physics", Macmillan India ltd, 1st Edition, 2000. 4. Hitendra K. Malik, A. K. Singh, "Engineering Physics", McGraw-Hill Education, 1st Edition, 2009.
Web References:
1. http://link.springer.com/book 2. http://www.thphys.physics.ox.ac.uk 3. http://www.sciencedirect.com/science 4. http://www.e-booksdirectory.com
E-Text Books:
1. http://www.peaceone.net/basic/Feynman/ 2. http://physicsdatabase.com/free-physics-books/ 3. http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf 4. http://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html
Course Home Page:

ENVIRONMENTAL STUDIES

<table>
<tr><td colspan="11">II Semester: Common for all Branches</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AHS009</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Analyze the interrelationship between living organism and environment.
II. Understand the importance of environment by assessing its impact on the human world.
III. Enrich the knowledge on themes of biodiversity, natural resources, pollution control and waste management.

UNIT-I	ENVIRONMENT AND ECOSYSTEMS	Classes: 08

Environment: Definition, scope and importance of environment, need for public awareness; Ecosystem: Definition, scope and importance of ecosystem, classification, structure and function of an ecosystem, food chains, food web and ecological pyramids, flow of energy; Biogeochemical cycles; Biomagnifications.

UNIT-II	NATURAL RESOURCES	Classes: 08

Natural resources: Classification of resources, living and nonliving resources; Water resources: Use and over utilization of surface and ground water, floods and droughts, dams, benefits and problems; Mineral resources: Use and exploitation; Land resources; Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III	BIODIVERSITY AND BIOTIC RESOURCES	Classes: 10

Biodiversity and biotic resources: Introduction, definition, genetic, species and ecosystem diversity; Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and optional values; India as a mega diversity nation; Hot spots of biodiversity.

Threats to biodiversity: Habitat loss, poaching of wildlife, human-wildlife conflicts; Conservation of biodiversity: In situ and ex situ conservation; National biodiversity act.

UNIT-IV	ENVIRONMENTAL POLLUTION, POLLUTION CONTROL TECHNOLOGIES AND GLOBAL ENVIRONMENTAL PROBLEMS	Classes: 10

Environmental pollution: Definition, causes and effects of air pollution, water pollution, soil pollution, noise pollution; Solid waste: Municipal solid waste management, composition and characteristics of e-waste and its management; Pollution control technologies: Waste water treatment methods, primary, secondary and tertiary; Concepts of bioremediation; Global environmental problems and global efforts: Climate change, ozone depletion, ozone depleting substances, deforestation and desertification; International conventions / protocols: Earth summit, Kyoto protocol and Montreal protocol.

UNIT-V	ENVIRONMENTAL LEGISLATIONS AND SUSTAINABLE DEVELOPMENT	Classes: 09

Environmental legislations: Environmental protection act, air act1981, water act, forest act, wild life act, municipal solid waste management and handling rules, biomedical waste management and handling rules2016, hazardous waste management and handling rules, Environmental impact assessment(EIA); Towards sustainable future: Concept of sustainable development, population and its explosion, crazy consumerism, environmental education, urban sprawl, concept of green building.

Text Books:

1. Benny Joseph, "Environmental Studies", Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 1st Edition, 2006.
2. Erach Bharucha, "Textbook of Environmental Studies for Under Graduate Courses", Orient Black Swan, 2nd Edition, 2013.
3. Dr. P. D Sharma, "Ecology and Environment", Rastogi Publications, New Delhi, 12th Edition, 2015.

Reference Books:

1. Tyler Miller, Scott Spoolman, "Environmental Science", Cengage Learning, 14th Edition, 2012.
2. Anubha Kaushik, "Perspectives in Environmental Science", New Age International, New Delhi, 4th Edition, 2006.
3. Gilbert M. Masters, Wendell P. Ela, "Introduction to Environmental Engineering and Science, Pearson, 3rd Edition, 2007.

Web References:

1. https://www.elsevier.com
2. https://www. libguides.lib.msu.edu
3. https://www.fao.org
4. https://www nrc.gov
5. https://www istl.org
6. https://www.ser.org
7. https://www.epd.gov.
8. https://www.nptel.ac.in

E-Text Books:

1. http://www.ilocis.org
2. http://www.img.teebweb.org
3. http://www.ec.europa.eu
4. http://www.epa.ie
5. http://www.birdi.ctu.edu.vn

Course Home Page:

COMPUTER PROGRAMMING

II Semester: AE / CE / ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACS001	Foundation	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Learn adequate knowledge by problem solving techniques.
II. Understand programming skills using the fundamentals and basics of C Language.
III. Improve problem solving skills using arrays, strings, and functions.
IV. Understand the dynamics of memory by pointers.
V. Study files creation process with access permissions.

UNIT-I	INTRODUCTION	Classes: 10

Introduction to computers: Computer systems, computing environments, computer languages, creating and running programs, algorithms, flowcharts; Introduction to C language: History of C, basic structure of C programs, process of compiling and running a C program, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types; Operators and expressions: Operators, arithmetic, relational and logical, assignment operators, increment and decrement operators, bitwise and conditional operators, special operators, operator precedence and associativity, evaluation of expressions, type conversions in expressions, formatted input and output.

UNIT-II	CONTROL STRUCTURES, ARRAYS AND STRINGS	Classes: 10

Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements; Arrays: Concepts, one dimensional arrays, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi dimensional arrays; Strings concepts: String handling functions, array of strings.

UNIT-III	FUNCTIONS AND POINTERS	Classes: 09

Functions: Need for user defined functions, function declaration, function prototype, category of functions, inter function communication, function calls, parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions, storage classes, preprocessor directives.

Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, pointers and arrays, pointers as functions arguments, functions returning pointers.

UNIT-IV	STRUCTURES AND UNIONS	Classes: 08

Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, passing structures through pointers, self referential structures, unions, bit fields, typedef, enumerations; Dynamic memory allocation: Basic concepts, library functions.

UNIT-V	FILES	Classes: 08

Files: Streams, basic file operations, file types, file opening modes, file input and output functions, file status functions, file positioning functions, command line arguments.

Text Books:
1. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014. 2. B. A. Forouzan, R. F. Gillberg, "C Programming and Data Structures", Cengage Learning, India, 3rd Edition, 2014.
Reference Books:
1. W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd Edition, 1988. 2. Yashavant Kanetkar, "Exploring C", BPB Publishers, 2nd Edition, 2003. 3. E. Balagurusamy, "Programming in ANSI C", McGraw-Hill Education, 6th Edition, 2012. 4. Schildt Herbert, "C: The Complete Reference", Tata McGraw-Hill Education, 4th Edition, 2014. 5. R. S. Bichkar, "Programming with C", Universities Press, 2nd Edition, 2012. 6. Dey Pradeep, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2nd Edition, 2006.
Web References:
1. https://www.bfoit.org/itp/Programming.html 2. https://www.khanacademy.org/computing/computer-programming 3. https://www.edx.org/course/programming-basics-iitbombayx-cs101-1x-0 4. https://www.edx.org/course/introduction-computer-science-harvardx-cs50x
E-Text Books:
1. http://www.freebookcentre.net/Language/Free-C-Programming-Books-Download.htm 2. http://www.imada.sdu.dk/~svalle/courses/dm14-2005/mirror/c/ 3. http://www.enggnotebook.weebly.com/uploads/2/2/7/1/22718186/ge6151-notes.pdf
MOOC Course
1. https://www.alison.com/courses/Introduction-to-Programming-in-c 2. http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective-programming-in-c-and-c-january-iap-2014/index.htm
Course Home Page:

COMPUTATIONAL MATHEMATICS LABORATORY

<table>
<tr><td colspan="10">II Semester: AE / CE / ME</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AHS102</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>1</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 24</td><td colspan="3">Total Classes: 24</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Train the students how to approach for solving engineering problems.
II. Understand the concepts of algebra, calculus and numerical solutions using MATLAB software.
III. Enrich the knowledge in MATLAB and can apply for project works.

LIST OF EXPERIMENTS

Week-l	**BASIC FEATURES**

a. Features and uses.
b. Local environment setup.

Week-2	**ALGEBRA**

a. Solving basic algebraic equations.
b. Solving system of equations.
c. Two dimensional plots.

Week-3	**CALCULUS**

a. Calculating limits.
b. Solving differential equations.
c. Finding definite integral.

Week-4	**MATRICES**

a. Addition, subtraction and multiplication of matrices.
b. Transpose of a matrix.
c. Inverse of a matrix.

Week-5	**SYSTEM OF LINEAR EQUATIONS**

a. Rank of a matrix.
b. Gauss Jordan method.
c. LU decomposition method.

Week-6	**LINEAR TRANSFORMATION**

a. Characteristic equation.
b. Eigen values.
c. Eigen vectors.

Week-7	DIFFERENTIATION AND INTEGRATION
a. Higher order differential equations. b. Double integrals. c. Triple integrals.	
Week-8	**INTERPOLATION AND CURVE FITTING**
a. Lagrange polynomial. b. Straight line fit. c. Polynomial curve fit.	
Week-9	**ROOT FINDING**
a. Bisection method. b. Regula false method. c. Newton Raphson method.	
Week-10	**NUMERICAL DIFFERENTION AND INTEGRATION**
a. Trapezoidal, Simpson's method. b. Euler method. c. Runge Kutta method.	
Week-11	**3D PLOTTING**
a. Line plotting. b. Surface plotting. c. Volume plotting.	
Week-12	**VECTOR CALCULUS**
a. Gradient. b. Divergent. c. Curl.	

Reference Books:

1. Cleve Moler, "Numerical Computing with MATLAB", SIAM, Philadelphia, 2nd Edition, 2008.
2. Dean G. Duffy, "Advanced Engineering Mathematics with MATLAB", CRC Press, Taylor & Francis Group, 6th Edition, 2015.

Web Reference:

http://www.iare.ac.in

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: Microsoft Windows 7 and MATLAB

HARDWARE: 30 numbers of Desktop Computer systems

ENGINEERING PHYSICS LABORATORY

II Semester: AE / ME / CE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS105	Foundation	L	T	P	C	CIA	SEE	Total
		-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 28				Total Classes: 28		

OBJECTIVES:

The course should enable the students to:

I. Enrich the concept of rigidity modulus and frequency.
II. Enlighten the real time application of interference, diffraction and optical fibers.
III. Upgrade practical knowledge in magnetic induction, LED and LASER.

LIST OF EXPERIMENTS

Week	Topic
Week- l	INTRODUCTION TO PHYSICS LABORATORY
	Introduction to physics laboratory. Do's and Don'ts in physics lab.
Week- 2	MEASURING INSTRUMENTS AND TORSIONAL PENDULUM
	Batch I: Measurement of thickness of a wire and radius of a disc. Batch II: Determination of rigidity modulus of material of string-Torsional pendulum.
Week-3	MEASURING INSTRUMENTS AND TORSIONAL PENDULUM
	Batch I: Determination of rigidity modulus of material of string-Torsional pendulum. Batch II: Measurement of thickness of a wire and radius of a disc.
Week-4	STEWART AND GEE'S METHOD AND FREQUENCY OF LONGITUDINAL WAVES
	Batch I: Magnetic field along the axis of current carrying coil-Stewart and Gee's method. Batch II: Determining frequency of longitudinal waves
Week-5	STEWART AND GEE'S METHOD AND FREQUENCY OF LONGITUDINAL WAVES
	Batch I: Determining frequency of longitudinal waves. Batch II: Magnetic field along the axis of current carrying coil-Stewart and Gee's method.
Week-6	FREQUENCY OF TRANSVERSE WAVES AND LASER DIFFRACTION
	Batch I: Calculating frequency of transverse waves. Batch II: Wavelength of laser source-diffraction grating.
Week-7	FREQUENCY OF TRANSVERSE WAVES AND LASER DIFFRACTION
	Batch I: Wavelength of laser source-diffraction grating. Batch II: Calculating frequency of transverse waves.

Week-8	**SPECTROMETER AND DISPERSIVE POWER**
Batch I: Adjustments and minimum deviation in spectrometer. Batch II: Dispersive power of material of prism.	
Week 9	**SPECTROMETER AND DISPERSIVE POWER**
Batch I: Dispersive power of material of prism. Batch II: Adjustments and minimum deviation in spectrometer.	
Week-10	**NEWTON'S RINGS AND OPTICAL FIBER**
Batch I: Newton's rings-Radius of curvature of plano convex lens. Batch II: Evaluation of numerical aperture of given fiber.	
Week-11	**NEWTON'S RINGS AND OPTICAL FIBER**
Batch I: Evaluation of numerical aperture of given fiber. Batch II: Newton's rings-Radius of curvature of plano convex lens.	
Week-12	**LED CHARACTERISTICS AND LASER CHARACTERISTICS**
Batch I : V-I characteristics of LED. Batch II : Study of L-I characteristics of laser diode.	
Week-13	**LED CHARACTERISTICS AND LASER CHARACTERISTICS**
Batch I : Study of L-I characteristics of laser diode. Batch II : V-I characteristics of LED.	
Week-14	**REVISION**
Revision.	
Reference Books:	
1. C. L. Arora, "Practical Physics", S.Chand & Co., New Delhi, 3rd Edition, 2012. 2. Vijay Kumar, Dr. T. Radhakrishna, "Practical Physics for Engineering students", S M enterprises, 2nd Edition, 2014. 3. R. K. Shukla, Anchal Srivatsava, "Practical Physics", New age International, 2nd Edition, 2011.	
Web References:	
1. http://www.iare.ac.in	
Course Home Page:	

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS:

S.No	Name of the Component	Qty	Range
1	Melde's arrangement	10	Tuning fork frequency: 80-90Hz, DC coil 4 – 6 V, 2-3 A
2	Weight box	10	1mg-100g
3	Meter scale	10	1m
4	Stewart and Gees's set	10	Coil 2, 50, 200 turns
5	DC Ammeter	10	Digital Meter DC 0-20V
6	Battery eliminator	10	DC 2 A.
7	Laser source with retort and round stand	10	Semiconductor laser 670 nm
8	Grating	20	15000 LPI
9	Measuring tape	10	1m
10	Torsional Pendulum	10	Brass disc 1000gms wt, 1m steel wire with diameter 0.05 cm
11	Stop watch	20	+/- 1s
12	Screw gauge	10	+/- 0.001cm
13	Vernier calipers	10	+/- 0.01cm
14	Newtons travelling microscope	10	X10
15	Sodium Vapour Lamp	20	700 W
16	Transformer Sodium Vapour Lamp	10	1 KW
17	Numerical aperture kit	10	Optical power meter 660 nm
18	Bending loss tubes	10	Dia – 4 cm, 6 cm, 8 cm, 10 cm
19	Spectrometer	10	LC 1', Ramsden eye piece
20	Glass prisms	20	Crown glass prisms, 30mm x 30mm
21	Mercury lamp	20	Mercury bulb 160 W
22	LED boards	10	I/P 0-10V DC, Resistors 1k Ω-4K Ω
23	Digital ammeter	10	Digital Meter DC 0-20 Ma
24	Digital voltmeter	10	Digital Meter DC 0-20V
25	Probes	10	Dia – 4 mm
26	Laser Diode boards	10	I/P 0-10V DC, Resistors 1k Ω-4K Ω

COMPUTER PROGRAMMING LABORATORY

II Semester: Common for AE / CE / ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACS101	Foundation	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Formulate problems and implement algorithms using C programming language.
II. Develop programs using decision structures, loops and functions.
III. Learn memory allocation techniques using pointers.
IV. Use structured programming approach for solving of computing problems in real world.

LIST OF EXPERIMENTS

Week-1 OPERATORS AND EVALUATION OF EXPRESSIONS

a. Write a C program to check whether a number is even or odd using ternary operator.
b. Write a C program to perform the addition of two numbers without using + operator.
c. Write a C program to evaluate the arithmetic expression ((a + b / c * d - e) * (f - g)). Read the values a, b, c, d, e, f, g from the standard input device.
d. Write a C program to find the sum of individual digits of a 3 digit number.
e. Write a C program to read the values of x and y and print the results of the following expressions in one line:
   i. (x + y) / (x - y)
   ii. (x + y)(x - y)

Week-2 CONTROL STRUCTURES

a. Write a C program to find the sum of individual digits of a positive integer.
b. A Fibonacci sequence is defined as follows: The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
c. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
d. A character is entered through keyboard. Write a C program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol using if-else and switch case. The following table shows the range of ASCII values for various characters.

Characters	ASCII values
A – Z	65 – 90
a – z	97 – 122
0 – 9	48 – 57
Special symbols	0 – 47, 58 – 64, 91 – 96, 123 – 127

e. If cost price and selling price of an item is input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Write a C program to determine how much profit or loss incurred in percentage.

Week-3	CONTROL STRUCTURES

a. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use switch statement).
b. Write a C program to calculate the following sum:

$$sum = 1 - x^2 /2! + x^4 /4! - x^6 /6! + x^8 /8! - x^{10}/10!$$

c. Write a C program to find the roots of a quadratic equation.
d. Write a C program to check whether a given 3 digit number is Armstrong number or not.
e. Write a C program to print the numbers in triangular form

```
1
1 2
1 2 3
1 2 3 4
```

Week-4	ARRAYS

a. Write a C program to find the second largest integer in a list of integers.
b. Write a C program to perform the following:
   i. Addition of two matrices
   ii. Multiplication of two matrices
c. Write a C program to count and display positive, negative, odd and even numbers in an array.
d. Write a C program to merge two sorted arrays into another array in a sorted order.
e. Write a C program to find the frequency of a particular number in a list of integers.

Week-5	STRINGS

a. Write a C program that uses functions to perform the following operations:
   i. To insert a sub string into a given main string from a given position.
   ii. To delete n characters from a given position in a given string.
b. Write a C program to determine if the given string is a palindrome or not.
c. Write a C program to find a string within a sentence and replace it with another string.
d. Write a C program that reads a line of text and counts all occurrence of a particular word.
e. Write a C program that displays the position or index in the string S where the string T begins, or 1 if S doesn't contain T.

Week-6	FUNCTIONS

a. Write C programs that use both recursive and non-recursive functions
   i. To find the factorial of a given integer.
   ii. To find the greatest common divisor of two given integers.
b. Write C programs that use both recursive and non-recursive functions
   i. To print Fibonacci series.
   ii. To solve towers of Hanoi problem.
c. Write a C program to print the transpose of a given matrix using function.
d. Write a C program that uses a function to reverse a given string.

Week-7	POINTERS

a. Write a C program to concatenate two strings using pointers.
b. Write a C program to find the length of string using pointers.
c. Write a C program to compare two strings using pointers.
d. Write a C program to copy a string from source to destination using pointers.
e. Write a C program to reverse a string using pointers.

Week-8	STRUCTURES AND UNIONS

a. Write a C program that uses functions to perform the following operations:
   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition and subtraction of two complex numbers
   iv. Multiplication of two complex numbers. Note: represent complex number using a structure.
b. Write a C program to compute the monthly pay of 100 employees using each employee's name, basic pay. The DA is computed as 52% of the basic pay. Gross-salary (basic pay + DA). Print the employees name and gross salary.
c. Create a Book structure containing book_id, title, author name and price. Write a C program to pass a structure as a function argument and print the book details.
d. Create a union containing 6 strings: name, home_address, hostel_address, city, state and zip. Write a C program to display your present address.
e. Write a C program to define a structure named DOB, which contains name, day, month and year. Using the concept of nested structures display your name and date of birth.

Week-9	ADDITIONAL PROGRAMS

a. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$. For example: if n is 3 and x is 5, then the program computes 1+5+25+125. Print x, n, the sum. Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.
b. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
c. Write a C program to convert a Roman numeral to its decimal equivalent. E.g. Roman number CD is equivalent to 400.

Week-10	PREPROCESSOR DIRECTIVES

a. Define a macro with one parameter to compute the volume of a sphere. Write a C program using this macro to compute the volume for spheres of radius 5, 10 and 15 meters.
b. Define a macro that receives an array and the number of elements in the array as arguments. Write a C program for using this macro to print the elements of the array.
c. Write symbolic constants for the binary arithmetic operators +, -, *, and /. Write a C program to illustrate the use of these symbolic constants.

Week-11	FILES

a. Write a C program to display the contents of a file.
b. Write a C program to copy the contents of one file to another.
c. Write a C program to reverse the first n characters in a file, where n is given by the user.
d. Two files DATA1 and DATA2 contain sorted lists of integers. Write a C program to merge the contents of two files into a third file DATA i.e., the contents of the first file followed by those of the second are put in the third file.
e. Write a C program to count the no. of characters present in the file.

Week-12	**COMMAND LINE ARGUMENTS**

a. Write a C program to read arguments at the command line and display it.
b. Write a C program to read two numbers at the command line and perform arithmetic operations on it.
c. Write a C program to read a file name at the command line and display its contents.

Reference Books:

1. Yashavant Kanetkar, “Let Us C”, BPB Publications, New Delhi, 13th Edition, 2012.
2. Oualline Steve, “Practical C Programming”, O’Reilly Media, 3rd Edition, 1997.
3. King K N, “C Programming: A Modern Approach”, Atlantic Publishers, 2nd Edition, 2015.
4. Kochan Stephen G, “Programming in C – A Complete Introduction to the C Programming Language”, Sam’s Publishers, 3rd Edition, 2004.
5. Linden Peter V, “Expert C Programming: Deep C Secrets”, Pearson India, 1st Edition, 1994

Web References:

1. http://www.sanfoundry.com/c-programming-examples
2. http://www.geeksforgeeks.org/c
3. http://www.cprogramming.com/tutorial/c
4. http://www.cs.princeton.edu

Course Home Page:

COMPUTER AIDED ENGINEERING DRAWING PRACTICE

II Semester: **AE / CE / ME**

Course Code	Category	Hours /Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME102	**Foundation**	-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Summarize the fundamental principles of engineering drawing.
II. Understand the intersection of solids in different quadrants.
III. Convert the pictorial views into orthographic view and vice versa.
IV. Create intricate details of components through sections and develop its surfaces.
V. Understand the perspective projection of solids through vanishing and visual ray method.

UNIT-I	AutoCAD AND DVELOPMENT OF SURFACES WITH SECTIONAL VIEW	Hours:09

Introduction to AutoCAD: Geometrical construction; Sections and sectional views, sections of right regular solids, prisms, pyramids, cylinders and cones, auxiliary views, development of surfaces, development of surfaces of right regular solids prisms, pyramids, cylinders and cones.

UNIT-II	INTERSECTION OF SOLIDS	Hours:09

Intersection of solids: Intersection of prism versus prism, cylinder versus prism, cylinder versus cylinder and cylinder versus cone.

UNIT-III	ISOMETRIC PROJECTIONS	Hours:09

Isometric projections**:** Principles of isometric projections, isometric scale, isometric views, conventions. Isometric views of lines, planes, simple and compound solids, isometric views of objects having spherical parts.

UNIT-IV	TRANSFORMATION OF PROJECTIONS	Hours:09

Transformation of projections: Conversion of isometric views to orthographic views, conventions for simple objects; Construction of orthographic projections for given isometric projections.

UNIT-V	PERSPECTIVE PROJECTIONS	Hours:09

Perspective projections: Perspective view of points, lines, plane figures and simple solids, vanishing point method and visual ray method.

Reference Books:

1. N.D. Bhatt, “Engineering Drawing”, Charotar Publications, 49th Edition, 2012.
2. C. M. Agrawal, Basant Agrawal, “Engineering Drawing’’, Tata McGraw-Hill, 2nd Edition, 2013.
3. K. Venugopal, “Engineering Drawing and Graphics”, New Age Publications, 2nd Edition, 2010.
4. S. Trymbaka Murthy, “Computer Aided Engineering Drawing”, I. K. Publishers, 3rd Edition, 2011.
5. A. K. Sarkar, A. P. Rastogi, “Engineering Graphics with AutoCAD”, PHI Learning, 1st Edition, 2010.

Web References:
1. http://nptel.ac.in/courses/112103019/ 2. http://freevideolectures.com/Course/3420/Engineering-Drawing
E-Text Book:
1. https://books.google.co.in/books/about/Engineering_Drawing.html?id=_hdOU8kRb2AC
Course Home Page:
SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS: **SOFTWARE:** System Software: Microsoft Windows 7. Application Software: AutoCAD **HARDWARE:** 30 numbers of Desktop Computer Systems.

PROBABILITY AND STATISTICS

III Semester: ME / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS010	Foundation	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			

OBJECTIVES:

The course should enable the students to:

I. Enrich the knowledge of probability on single random variables and probability distributions.
II. Apply the concept of correlation and regression to find covariance.
III. Analyze the given data for appropriate test of hypothesis.

UNIT-I	SINGLE RANDOM VARIABLES AND PROBABILITY DISTRIBUTION	Classes: 09

Random variables: Basic definitions, discrete and continuous random variables; Probability distribution: Probability mass function and probability density functions; Mathematical expectation; Binomial distribution, Poisson distribution and normal distribution.

UNIT-II	MULTIPLE RANDOM VARIABLES	Classes: 09

Joint probability distributions, joint probability mass, density function, marginal probability mass, density functions; Correlation: Coefficient of correlation, the rank correlation; Regression: Regression coefficient, the lines of regression, multiple correlation and regression.

UNIT-III	SAMPLING DISTRIBUTION AND TESTING OF HYPOTHESIS	Classes: 09

Sampling: Definitions of population, sampling, statistic, parameter; Types of sampling, expected values of sample mean and variance, sampling distribution, standard error, sampling distribution of means and sampling distribution of variance.

Estimation: Point estimation, interval estimations; Testing of hypothesis: Null hypothesis, alternate hypothesis, type I and type II errors, critical region, confidence interval, level of significance. One sided test, two sided test.

UNIT-IV	LARGE SAMPLE TESTS	Classes: 09

Test of hypothesis for single mean and significance difference between two sample means, tests of significance difference between sample proportion and population proportion and difference between two sample proportions.

UNIT-V	SMALL SAMPLE TESTS AND ANOVA	Classes: 09

Small sample tests: Student t-distribution, its properties: Test of significance difference between sample mean and population mean; difference between means of two small samples. Snedecor's F-distribution and its properties; Test of equality of two population variances Chi-square distribution and it's properties; Test of equality of two population variances Chi-square distribution, it's properties, Chi-square test of goodness of fit; ANOVA: Analysis of variance, one way classification, two way classification.

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.

Reference Books:

1. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand & Co, New Delhi, 10th Edition, 2000.
2. N. P. Bali, "Engineering Mathematics", Laxmi Publications, 9th Edition, 2016.
3. Richard Arnold Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Prentice Hall, 8th Edition, 2013.

Web References:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.ocw.mit.edu/resourcs/#Mathematics
3. http://www.sosmath.com
4. http://www.mathworld.wolfram.com

E-Text Books:

1. http://www.keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktu-ebook-download.html
2. http://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks

Course Home Page:

THERMODYNAMICS

III Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME003	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

OBJECTIVES:

The course should enable the students to:

I. Understand the laws of thermodynamics and determine thermodynamic properties, gas laws.
II. Apply Knowledge of properties during various phases of pure substances, mixtures, usage of steam tables and Mollier chart, psychometric charts.
III. Understand the direction law and concept of increase in entropy of universe.
IV. Understand the working of ideal air standard, vapor cycles and evaluate their performance in open systems like steam power plants, internal combustion engines, gas turbines and refrigeration systems.

UNIT-I	**BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS**	**Classes : 09**

Basic concepts: System, control volume, surrounding, boundaries, universe, types of systems, macroscopic and microscopic viewpoints, concept of continuum, thermodynamic equilibrium, state, property, process, cycle, reversibility, quasi static process, irreversible process, causes of irreversibility, various flow and non flow processes ,energy in state and in transition, types-work and heat, point and path function, Zeroth law of thermodynamics, concept of quality of temperature, Principles of thermometry, reference points, constant volume gas thermometer, ideal gas scale, PMMI Joule's experiments, first law of thermodynamics, corollaries first law applied to a process, applied to a flow system, steady flow energy equation.

UNIT-II	**SECOND LAW OF THERMODYNAMICS**	**Classes : 09**

Limitations of the first law: thermal reservoir, heat engine, heat pump, parameters of performance, second Law of thermodynamics, Kelvin Planck and Clausius statements and their equivalence, Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialties, thermodynamic scale of temperature, Clausius inequality, Entropy, principle of Entropy increase, availability and irreversibility, thermodynamic potentials, Gibbs and Helmholtz functions, Maxwell relations, elementary treatment of the Third Law of thermodynamics.

UNIT-III	**PURE SUBSTANCES**	**Classes: 09**

Pure substances: Phase transformations, T-S and H-S diagrams, P-V-T surfaces, triple point at critical state properties during change of phase, dryness fraction, Mollier charts, various thermodynamic processes and energy transfer, steam calorimeter.

Perfect gas laws: Equation of state, specific and universal gas constants, throttling and free expansion processes, deviations from perfect gas model, Vander Waals equation of state.

UNIT-IV	**MIXTURES OF PERFECT GASES**	**Classes: 09**

Mixtures of perfect gases: Mole fraction, mass friction, gravimetric and volumetric analysis, volume fraction, Dalton's law of partial pressure, Avogadro's laws of additive volumes, and partial pressure, equivalent gas constant, internal energy, enthalpy, specific heats and entropy of mixture of perfect gases; psychometric properties, dry bulb temperature, wet bulb temperature, dew point temperature,

thermodynamic wet bulb temperature, specific humidity, relative humidity, saturated air, vapour pressure, degree of saturation, adiabatic saturation, Carrier's equation, Psychometric chart.		
UNIT-V	**POWER CYCLES**	**Classes : 09**
Power cycles: Otto, Diesel, Dual combustion cycles, description and representation on P-V and T-S diagram, thermal efficiency, mean effective pressures on air standard basis, comparison of cycles, introduction to Brayton cycle and Bell Coleman cycle.		
Text Books:		
1. P. K. Nag, "Engineering Thermodynamics", Tata McGraw-Hill, 4th Edition, 2008. 2. Yunus Cengel, Michael A. Boles, "Thermodynamics-An Engineering Approach", Tata McGraw-Hill, 7th Edition, 2011.		
Reference Books:		
1. J. B. Jones, R. E. Dugan, "Engineering Thermodynamics", Prentice Hall of India Learning, 1st Edition, 2009. 2. Y. V. C. Rao, "An Introduction to Thermodynamics", Universities Press, 3rd Edition, 2013. 3. K. Ramakrishna, "Engineering Thermodynamics", Anuradha Publishers, 2nd Edition, 2011. 4. Holman. J.P, "Thermodynamics", Tata McGraw-Hill, 4th Edition, 2013.		
Web References:		
1. https://en.wikipedia.org/wiki/Thermodynamics 2. https://en.wikipedia.org/wiki/Laws_of_thermodynamics 3. http://www.livescience.com/50776-thermodynamics.html 4. https://www3.nd.edu/~powers/ame.20231/planckdover.pdf		
E-Text Book:		
1. https://www3.nd.edu/~powers/ame.20231/planckdover.pdf 2. http://www.ebookdownloadz.net/2014/08/engineering-thermodynamics-by-pknag.html		
Course Home Page:		

MECHANICS OF SOLIDS

III Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME004	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the theory of elasticity, Hook's law and their constitutive relationships for 1-D, 2-D types of loading.

II. Derive the fundamental governing equations for bending and twisting moment and analyze various theories of failures.

III. Analyze the different types of stresses induced using Mohr's circle.

IV. Estimate the stresses developed in different types of mechanical elements like shafts, springs, thin cylinders.

UNIT-I	SIMPLE STRESSES AND STRAINS	Classes: 09

Elasticity and plasticity, types of stresses and strains, Hooke's law, stress–strain diagram for engineering materials working stress, factor of safety, lateral strain, poisson's ratio and volumetric strain, elastic moduli and the relationship between them, bars of varying section, composite bars, stresses due to temperature change, strain energy, resilience, gradual, sudden, impact and shock loadings.

UNIT-II	SHEAR FORCE AND BENDING MOMENT	Classes: 09

Definition of beam, types of beams, concept of shear force and bending moments and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L, uniformly varying loads and combination of these loads, point of contraflexure, relation between S.F., B.M and rate of loading at a section of a beam.

UNIT-III	FLEXURAL STRESSES, SHEAR STRESSES	Classes: 09

Theory of simple bending, assumptions, derivation of bending equation: $M/I = \sigma/y = E/R$, Neutral axis, determination of bending stresses, section modulus of rectangular, circular sections (Solid and Hollow).

I, T, Angle and channel sections, design of simple beam sections. shear Stresses: Derivation of formula, Shear stress distribution across various beams sections viz rectangular, circular, triangular, I, T angle sections.

UNIT-IV	PRINCIPAL STRESSES AND STRAINS, THEORIES OF FAILURE	Classes: 09

Introduction, stresses on an inclined section of a bar under axial loading, compound stresses, normal and tangential stresses on an inclined plane for biaxial stresses, two perpendicular normal stresses accompanied by a state of simple shear, Mohr's circle of stresses, principal stresses and strains, analytical and graphical solutions, theories of failure: Introduction, various theories of failure, maximum principal stress theory, maximum principal strain theory, strain energy and shear strain energy theory (Von Misses Theory), maximum shear stress theory.

UNIT-V	DESIGN OF CIRCULAR SHAFTS AND STRESSES IN PRESSURE VESSELS	Classes: 09
Theory of pure torsion, derivation of torsion equations T/J = q/r = Gθ/L, assumptions made in the theory of pure torsion, torsional moment of resistance, polar section modulus, power transmitted by shafts, combined bending and torsion and end thrust, design of composite shaft, design of shafts according to theories of failure; thin cylinders, thin seamless cylindrical shells, derivation of formula for longitudinal and circumferential stresses, hoop stress, longitudinal and volumetric strains, changes in diameter, and volume of thin cylinders, thin spherical shells, and efficiency of a joint.		
Text Books:		
1. R. S. Kurmi, Gupta, "Strength of Materials", S Chand & Co, New Delhi, 1st Edition, 2013. 2. Egor P. Popov, "Solid Mechanics" Pearson, 2nd Edition, 2002. 3. Ryder. G.H, "Strength of Materials", Macmillan Long Man Publications, 3rd Edition, 2002. 4. W.A. Nash, "Strength of Materials", Tata McGraw-Hill, 4th Edition, 2007. 5. S. S Ratan, "Strength of Materials", Tata McGraw-Hill, 2nd Edition, 2011.		
Reference Books:		
1. Jindal, "Strength of Materials", Pearson Education, 1st Edition, 2012. 2. Vazirani, Ratwani, "Analysis of Structures", Khanna Publishers, 19th Edition, 2014. 3. H.J.Shah, S.B.Junnarkar, "Mechanics of Structures", Charotar Publishing House Pvt. Ltd, 31st Edition, 2014. 4. S. Ramamrutam, R. Narayan, "Strength of Materials", Dhanpat Rai Publishing Company, 18th Edition, 2014. 5. R. K. Rajput, "Strength of Materials", S.Chand & Co New Delhi, 4th Edition, 2007.		
Web References:		
1. https://www.youtube.com/watch?v=whB7IX3NQpg&list=PL49866E92803B242C 2. https://www.youtube.com/watch?v=vidZ1p82oCg 3. http://web.mit.edu/emech/dontindex-build/		
E-Text Book:		
1.http://royalmechanicalbuzz.blogspot.in/2015/04/strength-of-materials-book-by-r-k-bansal.html		
Course Home Page:		

METALLURGY AND MATERIAL SCIENCE

III Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME005	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the physical and mechanical, metallurgical engineering concepts for metals and preparation of alloys.

II. Analyze the microstructures of metals, alloys and relationship to heat treatment.

III. Compare the properties of ceramics, glasses, composites and polymers for industrial applications.

UNIT-I	STRUCTURE OF METALS	Classes: 09

Structure of metals: Crystallography, Miller indices, packing efficiency, density calculations, grains and grain boundaries, effect of grain size on the properties, determination of grain size by different methods, constitution of alloys, necessity of alloying, types of solid solutions, Hume-Rothery rules, intermediate alloy phases.

UNIT-II	PHASE DIAGRAMS	Classes: 09

Phase Diagrams: Construction and interpretation of phase diagrams, phase rule, Lever rule. binary phase diagrams, isomorphous, eutectic and eutectoid transformations with examples.

UNIT-III	ENGINEERING MATERIALS-I	Classes: 09

Engineering Materials I: Steels and Iron-Carbon phase diagram and heat treatment, study of iron - carbon diagram.

Construction of TTT diagrams, annealing, normalizing, hardening and tempering of steels, hardenabilty,

UNIT-IV	ENGINEERING MATERIALS-II,III	Classes: 09

Engineering Materials II: Cast Irons, Structure and properties of White cast iron, malleable cast iron, grey cast iron. Engineering Materials III: Non-ferrous metals and alloys, structure and properties of aluminum copper and its alloys, al - cu phase diagram, titanium and its alloys.

UNIT-V	ENGINEERING MATERIALS-IV	Classes: 09

Engineering Materials IV: Ceramics, Polymers and composites; Crystalline ceramics, glasses, cermets, Structure, properties and applications; Classification, properties and applications of composites, classification, properties and applications of polymers.

Text Books:

1. Sidney H Avner, “Introduction to Physical Metallurgy”, McGraw-Hill Education, 2nd Edition, 2008.
2. Donald R Askeland, Thomson, “Essentials of Material Science and Engineering”, Thomson Press, 1st Edition, 2005.

Reference Books:
1. Kodgire, "Material Science and Metallurgy", Everst Publishing House, 12^{th} Edition, 2002. 2. William, Callister, "Material science and Engineering", Wiley, 9^{th} Edition, 2014. 3. V Raghavan, "Elements of Material Science", PHI Learning Company Pvt Ltd, 6^{th} Edition, 2015. 4. Er. Amandeep Singh Wadhva, "Engineering Materials and Metallurgy", Laxmi Publications, 1^{st} Edition, 2008. 5. Traugott Fisher, "Material Science", Academic Press Elsevier, 1st Edition, 2013.
Web References:
1. https://www.youtube.com/user/MaterialsScience2000 2. http://www.nptel.ac.in/courses/113105023/
E-Text Books:
1. http://engineeringstudymaterial.net/ebook/material-science-and-engineering-an-introduction 2. http://www.scoopworld.in/2015/04/metallurgy-sciencem-text-books-and-notes.html 3. http://engineeringstudymaterial.net/ebook/material-science-and-engineering-an-introduction/ 4. https://books.google.co.in/books/about/Material_Science_and_Metallurgy.html?id=au1bG8BA_Z8C
Course Home Page:

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

III Semester: **AE / ME / CE**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE018	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand Kirchhoff laws and their application in series and parallel electric circuits.
II. Discuss principle and operation of measuring instruments.
III. Analyze the characteristics of alternating quantities, DC machines and AC machines.
IV. Illustrate the V-I characteristics of various diodes and bi-polar junction transistor.

UNIT – I	ELECTRIC CIRCUITS ,ELECTROMAGNETISM AND INSTRUMENTS	Classes: 10

Electrical Circuits**:** Basic definitions, types of elements, Ohm's Law, resistive networks, inductive networks, capacitive networks, Kirchhoff's Laws, Series, parallel circuits and star delta transformations, simple problems, Faradays law of electromagnetic induction; Instruments: Basic principles of indicating instruments, permanent magnet moving coil and moving iron instruments.

UNIT - II	DC MACHINES	Classes: 10

DC Machines: Principle of operation DC Generator, EMF equation, types, DC motor types, torque equation applications, three point starter.

UNIT - III	ALTERNATING QUANTITIES AND AC MACHINES	Classes: 08

Alternating quantities: sinusoidal AC voltage, average, RMS, form and peak factor, concept of three phase alternating quantity; Transformer: Principle of operation, EMF equation, losses, efficiency and regulation.

Three phase induction motor: Principle of operation, slip, slip - torque characteristics, efficiency and applications; Alternator: Principle of operation, EMF Equation, efficiency, and regulation by synchronous impedance method.

UNIT - IV	SEMICONDUCTOR DIODE AND APPLICATIONS	Classes: 09

Semiconductor diode: P-N Junction diode, symbol, V-I characteristics, half wave rectifier, full wave rectifier, bridge rectifier and filters, diode as a switch, Zener diode as a voltage regulator.

UNIT - V	BIPOLAR JUNCTION TRANSISTOR AND APPLICATIONS	Classes: 08

Bipolar junction: DC characteristics, CE, CB, CC configurations, biasing, load line, Transistor as an amplifier.

Text Books:

1. A Chakrabarti, “Circuit Theory”, Dhanpat Rai Publications, 6th Edition, 2004.
2. K S Suresh Kumar, “Electric Circuit Analysis”, Pearson Education, 1st Edition, 2013.
3. Willianm Hayt, Jack E Kemmerly S.M.Durbin, “Engineering Circuit Analysis”, Tata McGraw-Hill, 7th Edition, 2010.
4. J P J Millman, C C Halkias, Satyabrata Jit, “Millman’s Electronic Devices and Circuits”, Tata McGraw-Hill, 2nd Edition, 1998.
5. R L Boylestad, Louis Nashelsky, “Electronic Devices and Circuits”, PEI/PHI, 9th Edition, 2006.
6. V K Mehta, Rohit Mehta, “Principles of Electrical Engineering”, S Chand & co,New Delhi, 1st Edition, 2003.

Reference Books:

1. David A Bell, “Electric Circuits”, Oxford University Press, 9th Edition, 2016.
2. M Arshad, “Network Analysis and Circuits”, Infinity Science Press, 9th Edition, 2016.
3. A Bruce Carlson, “Circuits”, Cengage Learning, 1st Edition, 2008.
4. M Arshad, “Network Analysis and Circuits”, Infinity Science Press, 9th Edition, 2016.
5. A Bruce Carlson, “Circuits”, Cengage Learning, 1st Edition, 2008

Web References:

1. https://www.kuet.ac.bd/webportal/ppmv2/uploads/1364120248DC%20Machines2.pdftextofvideo.nptel.iitm.ac.in
2. https://www.eleccompengineering.files.wordpress.com/2014/08/a-textbook-of-electrical-technology-volume-ii-ac-and-dc-machines-b-l-thferaja.pdf
3. https://www.geosci.uchicago.edu/~moyer/GEOS24705/Readings/Klempner_Ch1.pdf
4. https://www.ibiblio.org/kuphaldt/electricCircuits/DC/DC.pdf
5. https://www.users.ece.cmu.edu/~dwg/personal/sample.pdf.
6. https://www.djm.cc/library/Principles_of_Alternating_Current_Machinery_Lawrence_edited.pdf

E-Text Books:

1. https://www.kisi.deu.edu.tr/aytac.goren/ELK2015/w10.pdfwww.bookboon.com.
2. https://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/lecture-notes/19_bjt_1.pdf.
3. https://www.google.co.in/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=half+and+full+wave+rectifier+pdf.
4. https://www.leka.lt/sites/default/files/vaizdai/concepts-in-electric-circuits.pdf.
5. https://www.ktustudents.in

Course Home Page:

METALLURGY AND MECHANICS OF SOLIDS LABORATORY

III Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME104	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32			Total Classes: 32			

OBJECTIVES:

The course will enable the students to:

I. Determination of mechanical properties of different materials.
II. Establish the constitutive relations in metals using destructive methods.
III. Understand the behaviour of members during twisting and transverse loading.
IV. Familiarize with standard test specimens.
V. Prepare samples for investigating micro structure of different materials.

LIST OF EXPERIMENTS

Week	Experiment
Week-1	**MICROSTRUCTURE OF PURE METALS**
Preparation and study of the micro Structure of pure metals like iron, cu and al.	
Week-2	**MICROSTRUCTURE OF STEELS**
Preparation and study of the microstructure of mild steels, low carbon steels, high–C steels.	
Week-3	**MICROSTRUCTURE OF CAST IRON**
Study of the micro structures of cast irons.	
Week-4	**MICROSTRUCTURE OF NON FERROUS ALLOYS**
Study of the micro structures of non-ferrous alloys.	
Week-5	**MICROSTRUCTURE OF HEAT TREATED STEELS**
Study of the micro structures of heat treated steels.	
Week-6	**HARDENABILITY OF STEELS**
Hardenability of steels by jominy end quench test.	
Week-7	**HARDNESS OF STEELS**
To find out the hardness of various treated and untreated steels.	
Week-8	**TENSION TEST**
To Find % of elongation and young's modulus of a material.	

Week-9	TORSION TEST
To find the torsional rigidity of a material.	
Week-10	**HARDNESS TEST**
a) Brinell's hardness test. b) Rockwell hardness test.	
WeeK-11	**SPRING TEST**
Testing on compressive and elongation springs.	
Week-12	**COMPRESSION TEST**
Compression test on springs.	
Week-13	**IMPACT TEST**
a) Charpy. b) Izod test.	
Week-14	**SHEAR TEST**
Punch shear test on aluminium sheet.	
Text Books:	
1. Sidney H Avner, "Introduction to Physical Metallurgy", McGraw-Hill Education, 2nd Edition, 2008. 2. William, Callister, "Material Science and Engineering", Wiley, 9th Edition, 2014. 3. V Raghavan, "Elements of Material Science", PHI Learning Company Pvt Ltd, 6th Edition, 2015. 4. Er.Amandeep Singh Wadhva, "Engineering Materials and Metallurgy", Laxmi Publications, 1st Edition, 2008. 5. Traugott Fisher, "Material Science", 1st Edition, Academic Press Elsevier, 2013.	
Web References:	
1. http://www.iare.ac.in	
Course Home Page:	

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S.NO	EQUIPMENT NAME	QUANTITY
1	Jominy end quench test rig	1
2	Trinocular with video camera	1
3	Mounting press	1
4	Cut off machine	1
5	Belt polisher	1
6	Muffle furnace	1
7	Rockwell hardness test	1
8	Specimens	1
10	Metallurgic micro-scope	1
11	Disc polisher	1
12	ASME grain size measurement 10x eye piece	1
13	Torsion testing machine	1
14	Cantiliver test rig	1
15	Universal testing machine	1
16	Bending test rig	1
17	Hardeness testing machine	1
18	Impact testing machine	1
20	Spring testing machine	1
21	Hardness testing machine	1
22	Compression testing machine	1
23	Mechanical extenso meter	1
24	Brinell’s hardness tester	1
25	Vernier caliper	1

MACHINE DRAWING THROUGH CAD LABORATORY

<table>
<tr><td colspan="10">III Semester: ME</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AME105</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 42</td><td colspan="3">Total Classes: 42</td></tr>
</table>

OBJECTIVES:

The course should enable students to

I. Understand Code of drawing practice as per BIS conventions for mechanical elements using AutoCAD.
II. Practice the drawing methods for sectioning of joints, couplings, bearings, keys.
III. Prepare assembly drawings, sectional views and bill of materials for selected assemblies.

LIST OF EXERCISES

Week-1	**CONVENTIONAL REPRESENTATION**

Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs; Introduction to AutoCAD.

Week-2	**SECTIONAL VIEWS**

Types of sections, selection of section planes and drawing of sections and auxiliary sectional views, parts not usually sectioned.

Week-3	**DIMENSIONING**

Methods of dimensioning, general rules for sizes, and placement of dimensions for holes, centers, and curved and tapered features.

Week-4	**WORKING DRAWINGS**

Types of drawings–working drawings for machine parts.

Week-5	**MACHINE ELEMENTS**

Drawing of machine elements and simple parts; Selection of orthogonal views and additional views for the following machine elements and parts with drawing proportion, popular forms of screw threads, bolts, nuts and stud bolts.

Week-6	**KEYS AND COTTER JOINTS**

Keys, cotter joints, and knuckle joint.

Week-7	**RIVETED JOINTS**

Riveted joints for plates.

Week-8	**COUPLINGS**

Shaft couplings and spigot joint.

Week-9	BEARINGS
Journal, pivot, and collar bearing.	
Week-10	**ASSEMBLY DRAWINGS-ENGINE PARTS**
Assembly drawings Assembly drawings for the following, using conventions and drawing proportions: Engine parts–stuffing box.	
Week-11	**CONNECTING ROD AND ECCENTRIC**
Eccentrics, I.C. engine connecting rod.	
WeeK-12	**SCREW JACK**
Screw jack.	
Week-13	**TAIL STOCK AND MACHINE VICE**
Machine vice and tailstock.	
Week-14	**SAFETY VALVES**
Rams-bottom Safety Valve, feed check valve.	

Text Books:

1. K.L. Narayana, P. Kannaiah, K. Venkata Reddy, "Machine Drawing", New Age Publishers, 3rd Edition, 2012.
2. K.C. John, "Text book of Machine Drawing", PHI Eastern Economy, 1st Edition, 2010.
3. P.S Gill, "Machine Drawing", S.K Kataria & Sons, 1stEdition, 2013.
4. Junnarkar N.D, "Machine Drawing", Pearson Education, 1st Edition, 2007.
5. Basudeb Bhattacharya, "Machine Drawing", Oxoford University Press, 1st Edition, 2011.
6. N. D. Bhatt, V. M Pancahal, "Machine Drawing", Charotar, 2014.
7. R. K. Dhavan, "A Text book of Machine drawing", S.Chand Publication & Co, New Delhi, 2nd Edition, 2008.

Web References:

1. http://web.iitd.ac.in/~achawla/public_html/201/sheets/sheet5/sheet5.pdf
2. https://drive.google.com/file/d/0B_GCh7LMfHf6Z0VNWTNHU3pMSTg/view?pref=2&pli=1
3. http://www.uiet.co.in/downloads/20140911122818-Machine20Drawing.pdf
4. http://listpdf.com/ma/machine-drawing-book-pdf.html

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: System Software: Microsoft Windows 7.
Application Software: AutoCAD.

HARDWARE: 36 numbers of Desktop Computer Systems

BASIC ELECTRICAL AND ELCTRONICS ENGINEERING LABORATORY

III Semester: AE / ME									
Course Code	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
AEE103	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 42**				**Total Classes: 42**		

OBJECTIVES:

The course should enable the students to:

I. Analysis of basic concepts of electric circuits.
II. Study the performance of DC machines and AC machines.
III. Understand the characteristics of electronic components.

LIST OF EXPERIMENTS

Week - 1	**KIRCHOFF'S CURRENT LAW AND VOLTAGE LAW**
Verification of Kirchhoff's current and voltage laws.	
Week - 2	**OHMS LAW**
Verification of ohms law.	
Week - 3	**OPEN CIRCUIT CHARACTERISTICS OF DC SHUNT GENERATOR**
Magnetization characteristics of DC shunt generator.	
Week - 4	**SWINBURNE'S TEST**
Predetermination of efficiency (Swinburne's test) of DC shunt machine.	
Week - 5	**OPEN CIRCUIT AND SHORT CIRCUIT TEST**
Open circuit and short circuit test on single phase transformer.	
Week - 6	**BRAKE TEST ON THREE PHASE INDUCTION MOTOR**
Study the performance characteristics of three phase induction motor by brake test.	
Week - 7	**REGULATION OF ALTERNATOR**
Determine the regulation of alternator using synchronous impedance method.	
Week - 8	**PN JUNCTION DIODE**
PN junction diode characteristics.	

Week - 9	**ZENER DIODE**
Zener diode characteristics.	
Week - 10	**HALF WAVE RECTIFIER CIRCUIT**
Half wave rectifier circuit.	
Week - 11	**FULL WAVE RECTIFIER CIRCUIT**
Full wave rectifier circuit.	
Week - 12	**TRANSISTOR**
Transistor common emitter characteristics.	
Week - 13	**TRANSISTOR**
Transistor common base characteristics.	
Week - 14	**CRO**
Study of CRO.	

Reference Books:

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 2004.
2. N C Jagan, C Lakshminarayana", Network Analysis", B S Publications.
3. J P J Millman, C C Halkias, Satyabrata Jit, "Millman"s Electronic Devices and Circuits", Tata McGraw-Hill, 2nd Edition, 1998.
4. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI/PHI, 9th Edition, 2006.

Web References:

1. https://www.nptel.ac.in/Courses/117106108
2. https://www.gnindia.dronacharya.info/EEEDept/labmanuals.html
3. https://www.textofvideo.nptel.iitm.ac.in
4. https://www.textofvideo.nptel.iitm.ac.in/

Course Home Page:

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S.No	Name of the Equipments	Range
1	Regulated Power Supply	0-30 V DC
2	Cathode Ray Oscilloscope	
3	1-ϕ Transformer	3 KVA
4	3-ϕ Induction Motor	--
5	1-ϕ Variac	0-230/270 V, 15A
6	3-ϕ Variac	0-440v/470 V, 15A
7	DC Shunt Motor Coupled with DC Generator	--
8	Ammeter	0-2.5/5A MI
9	Ammeter	0-10/20 A MI
10	Voltmeter	0-150/300V MI
11	Voltmeter	0-300/600V MI
12	Wattmeter	5/10A,75/150/300V LPF
13	Wattmeter	10/20A,150/300/600V UPF
14	Control Panels	--
15	Tachometers	0-9999 RPM
16	Resistors	150Ω,470Ω,1kΩ,2.2kΩ,10kΩ,47kΩ,100kΩ,1MΩ
17	Capacitors	0.1 µF,10 µF, 100 µF
18	Diode	1N4007
19	Zener Diode	4.7 V
20	Transistors	BC107
21	Decade Resistance Box	10Ω-10 MΩ
22	Voltmeter	0-20V
23	Ammeter	0-200 µA, 0-10 µA, 0-1 mA, 0-10 mA
24	Bread Board	--
25	Trainer Kits	--
26	Connecting Wires	--

MATHEMATICAL TRANSFORMS TECHNIQUES

IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS011	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Express non periodic function to periodic function using Fourier series and Fourier transforms.
II. Apply Laplace transforms and Z-transforms to solve differential equations.
III. Formulate and solve partial differential equations.

UNIT-I	FOURIER SERIES	Classes: 09

Definition of periodic function, determination of Fourier coefficients; Fourier expansion of periodic function in a given interval of length 2π; Fourier series of even and odd functions; Fourier series in an arbitrary interval; Half- range Fourier sine and cosine expansions.

UNIT-II	FOURIER TRANSFORMS	Classes: 09

Fourier integral theorem, Fourier sine and cosine integrals; Fourier transforms; Fourier sine and cosine transform, properties, inverse transforms, finite Fourier transforms.

UNIT-III	LAPLACE TRANSFORMS	Classes: 09

Definition of Laplace transform, linearity property, piecewise continuous function, existence of Laplace transform, function of exponential order, first and second shifting theorems, change of scale property, laplace transforms of derivatives and integrals, multiplied by t, divided by t, laplace transform of periodic functions.

Inverse laplace transform: Definition of inverse laplace transform, linearity property, first and second shifting theorems, change of scale property, multiplied by s, divided by s; Convolution theorem and applications.

UNIT-IV	Z –TRANSFORMS	Classes:09

Z-transforms: Elementary properties, inverse Z-transform, convolution theorem, formation and solution of difference equations.

UNIT-V	PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS	Classes: 09

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equation by Lagrange method; Charpit's method; method of separation of variables; One dimensional heat and wave equations under initial and boundary conditions.

Text Books:
1. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 10^{th} Edition, 2010. 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42^{nd} Edition, 2013.
Reference Books:
1. S. S. Sastry, "Introduction methods of numerical analysis", Prentice-Hall of India Private Limited, 5^{th} Edition, 2005. 2. G. Shanker Rao, "Mathematical Methods", I. K. International Publications, 1^{st} Edition, 2011.
Web References:
1. http://www.efunda.com/math/math_home/math.cfm 2. http://www.ocw.mit.edu/resources/#Mathematics 3. http://www.sosmath.com/ 4. http://www.mathworld.wolfram.com/
E-Text Books:
1. http://www.keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktu-ebook- download.html 2. http://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks
Course Home Page:

PRODUCTION TECHNOLOGY

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME006	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			`Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Comprehensive understanding of different manufacturing processes for product development.
II. Apply, casting, metal joining and forming processes for various industries.
III. Select process parameters, equipment for material processing.

UNIT-I	CASTING	Classes: 09

Casting: Steps involved in making a casting, it's applications, patterns and types of patterns, pattern allowances and their construction, types of casting processes, solidification of casting.

UNIT-II	WELDING-I	Classes: 09

Welding: Welding types, Oxy-fuel gas welding, cutting, standard time and cost calculations, arc welding process, forge welding, resistance welding, thermit welding.

UNIT-III	WELDING-II	Classes: 09

Welding: Inert gas welding, TIG welding, MIG welding, friction welding, induction pressure welding, explosive welding, electron beam welding, laser welding, soldering and brazing.

Heat affected zone in welding, welding defects, causes and remedies, destructive and non-destructive testing of welds.

UNIT-IV	FORMING	Classes: 09

Forming: Hot working, cold working, strain hardening, recovery, re-crystallization and grain growth, comparison of properties of cold and hot worked parts, rolling fundamentals, theory of rolling, types of rolling mills and products; Forces in rolling and power requirements, stamping, forming and other cold working processes: Blanking and piercing, bending and forming, drawing and its types, wire drawing and tube drawing; coining; hot and cold spinning, types of presses and press tools, forces and power requirements for the above operations.

UNIT-V	EXTRUSION, FORGING	Classes: 09

Extrusion of Metals: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, forward extrusion and backward extrusion, impact extrusion, extruding equipment, tube extrusion and Pipe making, hydrostatic extrusion, forces in extrusion; Forging processes: Forging operations and principles, tools, forging methods, Smith forging, drop forging, roll forging, forging hammers: Rotary forging, forging defects, cold forging, swaging, forces in forging operations.

Text Books:

1. P. N. Rao, "Manufacturing Technology", Tata McGraw-Hill, 2nd Edition, 2013.
2. Hajra Chowdhary, "Workshop Technology", Asia Publishing House, 2nd Edition, 2008.

Reference Books:
1. Sarma P C, "Production Technology", S.Chand & CO, New Delhi, 7^{th} Edition, 2006. 2. R. K. Jain, "Production Technology", Khanna Publishers, 18^{th} Edition, 2013. 3. T. V. Ramana Rao, "Metal Casting", New Age, 1^{st} Edition, 2010. 4. Philips Rosenthal, "Principles of Metal Castings", Tata McGraw-Hill, 2^{nd} Edition, 2001. 5. B. S. Raghuwamshi, "A Course in Workshop Technology", Dhanpat Rai & Sons, 2014. 6. Kalpakjain S, "Manufacturing Engineering and Technology", Pearson Education, 7^{th} Edition, 2014. 7. HMT, "Production Technology", McGraw-Hill Education, 1^{st} Edition, 2013.
Web References:
1. http://www.nptel.ac.in/courses/112107144/13 2. http://www.nptel.ac.in/courses/112107145/ 3. http://www.nptel.ac.in/courses/112107144/
E-Text Books:
1. http://www.a-zshiksha.com/ebook/engineering/me/production_technology_by_hmt.php 2. http://royalmechanicalbuzz.blogspot.in/2015/04/manufacturing-engineering-by-kalpakjian.html 3. http://link.springer.com/book/10.1007%2F978-3-319-12304-2
Course Home Page:

APPLIED THERMODYNAMICS

IV Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME007	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Visualize the construction and working of internal combustion engines, compressors and refrigeration systems.
II. Compare the ideal and real working of thermodynamic cycles for performance evaluation.
III. Understand the subsystems of internal combustion systems.
IV. Evaluate different refrigeration systems and air-conditioning systems using p-h charts.

UNIT-I	**I C ENGINES**	**Classes: 09**

I. C Engines: Four and two stroke engine, SI and CI engines, valve and port timing diagrams, fuel injection systems for SI engines, fuel injection systems for CI engines, ignition systems, cooling and lubrication system, fuel properties and combustion, stoichiometry.

UNIT-II	**COMBUSTION IN S I ENGINES AND CI ENGINES**	**Classes: 09**

Combustion in SI engines and CI engines: Normal combustion and abnormal combustion, importance of flame speed and effect of engine variables, type of abnormal combustion, pre-ignition and knocking, fuel requirements and fuel rating, anti knock additives, combustion chamber, requirements, types; Combustion in CI Engines: Four stages of combustion, delay period and its importance, effect of engine variables, diesel Knock, need for air movement, open and divided combustion chambers and nozzles used, fuel requirements and fuel rating.

UNIT-III	**TESTING AND PERFORMANCE**	**Classes: 09**

Testing and performance: Parameters of performance, measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, brake power, determination of frictional losses and indicated power, performance test, heat balance sheet. and chart;

Compressors: Classification, of compressors, fans, blower and compressor, positive displacement and dynamic types, reciprocating and rotary types.

UNIT-IV	**ROTARY, DYNAMIC AND AXIAL FLOW**	**Classes: 09**

Rotary, dynamic and axial flow (positive displacement): Roots blower, vane sealed compressor, mechanical details and principle of working efficiency considerations; Centrifugal compressors: mechanical details and principle of operation, velocity and Pressure variation, Energy transfer, impeller blade shape-losses, slip factor, and power input factor, pressure coefficient and adiabatic coefficient, velocity diagrams, power; Axial flow compressors: Mechanical details and principle of operation, velocity triangles and energy transfer per stage degree of reaction, work done factor, isentropic efficiency, pressure rise calculations, polytropic efficiency.

UNIT-V	REFRIGERATION	Classes: 09

Refrigeration: Mechanical refrigeration and types, units of refrigeration, air refrigeration system, details and principle of operation, applications of air refrigeration, vapour compression refrigeration systems, calculation of COP, effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants, vapour absorption system, mechanical details, working principle, use of p-h charts for calculations.

Text Books:

1. Ganesan, "I.C. Engines", Tata McGraw-Hill, 3rd Edition, 2011.
2. B. John Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw-Hill, 2nd Edition, 2011.
3. K. Rajput, "Thermal Engineering", Lakshmi Publications, 1st Edition, 2011.

Reference Books:

1. Mathur, Sharma, "IC Engines", Dhanpat Rai & Sons, 3rd Edition, 2008.
2. Pulkrabek, "Engineering Fundamentals of IC Engines", Pearson Education, 2nd Edition, 2008.
3. Rudramoorthy, "Thermal Engineering", Tata McGraw-Hill, 5th Edition 2003.
4. C. P. Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill Education, 3rd Edition, 2013.

Web References:

1. http://www.newworldencyclopedia.org/entry/Internal_combustion_engine
2. http://www.nptel.ac.in/courses/112106133/#
3. https://www.grc.nasa.gov/www/k-12/airplane/engopt.html

E-Text Books:

1. http://www.a-zshiksha.com/ebook/engineering/me/production_technology_by_hmt.php
2. http://www.royalmechanicalbuzz.blogspot.in/2015/04/manufacturing-engineering-by-kalpakjian.html
3. http://www.link.springer.com/book/10.1007%2F978-3-319-12304-2

Course Home Page:

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

Semester: IV ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME008	**Foundation**	**L**	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
		3	1	-	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic principles of fluid mechanics.

II. Identify various types of flows.

III. Understand boundary layer concepts and flow through pipes.

IV. Evaluate the performance of hydraulic turbines.

V. Understand the functioning and characteristic curves of pumps.

UNIT-I	FLUID STATICS	Classes: 09

Fluid Statics: Dimensions and units, Physical properties of fluids-specific gravity, viscosity, surface tension, vapour pressure and their influence on fluid motion, atmospheric, gauge and vacuum pressures, measurement of pressure, piezometer, U-tube and differential manometers.

UNIT-II	FLUID KINEMATICS, FLUID DYNAMICS	Classes :09

Fluid Kinematics: Stream line, path line, streak line and stream tube, classification of flows- steady and unsteady, uniform and non uniform, laminar and turbulent, rotational and irrotational flows, equation of continuity for one dimensional flow and three dimensional flows; Fluid dynamics: Surface and body forces, Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT-III	BOUNDARY LAYER CONCEPTS, CLOSED CONDUIT FLOW	Classes: 09

Boundary layer Concepts: Definition, thickness, characteristics along thin plate, Laminar and turbulent boundary layers, boundary layer in transition, Separation of boundary layer, submerged objects- drag and lift.

Closed Conduit flow: Reynolds's experiment, Darcy Weisbach equation, minor losses in pipes, Pipes in series and pipes in parallel, Total energy line, hydraulic gradient line, Measurement of flow, Pitot tube, venturi meter, and orifice meter, flow nozzle.

UNIT-IV	BASICS OF TURBO MACHINERY, HYDRAULIC TURBINES AND PERFORMANCE	Classes: 09

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined vanes, curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow radial vanes; Hydraulic turbines: classification of turbines, heads and efficiencies, impulse and reaction turbines, Peloton Wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design, draft tube theory, functions and efficiency; Performance of hydraulic turbines: Geometric similarity, unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT-V	CENTRIFUGAL PUMPS AND RECIPROCATING PUMPS	Classes 09

Centrifugal pumps: Classification, working, work done, barometric head losses and efficiencies, specific speed, performance characteristic curves, NPSH; Reciprocating pumps: working, discharge, slip, indicator diagrams.

Text Books:

1. Rajput, "Fluid Mechanics and Hydraulic Machines", S.Chand & Co, 6th Edition, 1998.
2. H Modi, Seth, "Hydraulics, Fluid Mechanics and Hydraulic Machinery", Rajsons Publications, 20th Edition, 2013.

Reference Books:

1. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", Kotaria & Sons, 2013.
2. D. Rama Durgaiah, "Fluid Mechanics and Machinery", New Age International, 1st Edition, 2002.
3. Banga, Sharma, "Hydraulic Machines", Khanna Publishers, 6th Edition, 2001.
4. Dr. R K Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 9th Edition, 2015.

Web References:

1. https://books.google.co.in/books?isbn=8173715491
2. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/machine/ui/Course_home-lec1a.html
3. http://nptel.ac.in/courses/112105171/1

E-Text Books:

1. https://books.google.co.in/books/about/Introduction_to_Fluid_Mechanics_and_Flui.html?id=Fh18yn0iNOsC&redir_esc=y
2. http://www.mechanicalgeek.com/fmhm-rk-bansal-book-pdf/
3. http://learneverythings.blogspot.com/2014/02/download-textbook-of-fluid-mechanics.html

Course Home Page:

KINEMATICS OF MACHINERY

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME009	Foundation	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic principles of kinematics and the related terminology of machines.
II. Discriminate mobility, enumerate links and joints in the mechanisms.
III. Formulate the concept of analysis of different mechanisms.
IV. Understand the working of various straight line mechanisms, gears, gear trains, steering gear mechanisms, cams and a Hooke's joint.
V. Analyze a mechanism for displacement, velocity and acceleration of links in a machine.

UNIT-I	MECHANISMS	Classes: 09

Mechanisms: Elements or links, classification, rigid link, flexible and fluid link, types of kinematic pairs types of constrained motion, kinematic chain, mechanism, machine, structure, inversion of mechanism, inversions of quadric cycle chain, single and double slider crank chains, mechanical advantage, Grubler's Criterion.

UNIT-II	KINEMATICS, PLANE MOTION OF BODY, ANALYSIS OF MECHANISMS	Classes: 09

Kinematics: Velocity and acceleration, motion of link in machine, determination of velocity and acceleration, Graphical method, application of relative velocity method, plane motion of body: Instantaneous center of rotation, centroids and axodes, three centers in line theorem, graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method. Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration; Analysis of mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider, acceleration diagram for a given mechanism.

UNIT-III	STRAIGHT LINE MOTION MECHANISMS, STEERING GEARS, HOOKE'S JOINT	Classes: 09

Straight-line motion Mechanisms: Exact and approximate copied and generated types, Peaucellier, Hart and Scott Russul, Grasshopper, Watt T. Chebicheff and Robert mechanisms, pantograph.

Steering gears: Conditions for correct steering, Davis Steering gear, Ackerman's steering gear, Hooke's joint: Single and double Hooke's joint, velocity ratio, application, problems.

UNIT-IV	CAMS, ANALYSIS OF MOTION OF FOLLOWERS	Classes: 09

Cams: Definitions of cam and followers, their uses, types of followers and cams, terminology, types of follower motion, uniform velocity, simple harmonic motion and uniform acceleration; Maximum velocity and maximum acceleration during outward and return strokes in the above three cases; Analysis of motion of followers: Tangent cam with roller follower, circular arc cam with straight, concave and convex flanks.

UNIT-V	HIGHER PAIRS, GEAR TRAINS	Classes: 09

Higher Pairs: friction wheels and toothed gears, types, law of gearing, condition for constant velocity ratio for transmission of motion, velocity of sliding, form of teeth, cycloidal and involute profiles, phenomena of interferences, methods of interference; Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact of pinion and gear pinion and rack arrangements; Introduction to helical, bevel and worm gearing; Gear trains: Introduction, types, simple and reverted gear trains, epicyclic gear train; Methods of finding train value or velocity ratio of epicyclic gear trains, selection of gear box, differential gear for an automobile.

Text Books:

1. Joseph E. Shigley, "Theory of Machines and Mechanisms", Oxford University Press, 4th Edition, 2010.
2. Thomas Bevan, "Theory of Machines", Pearson, 3rd Edition, 2009.

Reference Books:

1. Jagadish Lal, "Theory of Mechanisms and Machines", Metropolitan Book Company, 1st Edition, 1978.
2. S.S. Rattan, "Theory of Machines", Tata McGraw-Hill Education, 1st Edition, 2009.
3. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 3rd Edition, 2008.
4. Sadhu Singh, "Theory of Machines", Pearson, 2nd Edition, 2006.
5. J. S Rao, R. V Duggipati, "Mechanisms and Machine Theory", New Age Publishers, 2nd Edition, 2008.
6. R. K. Bansal, "Theory of Machines", Lakshmi Publications, 1st Edition, 2013.

Web References:

1. http://www.uobabylon.edu.iq/uobColeges/ad_downloads/4_1293_515.pdf
2. http://ebooks.library.cornell.edu/k/kmoddl/toc_hartenberg1.html

E-Text Books:

1. https://drive.google.com/file/d/0B7raaoEF40D7eEJIR1VoODJodFE/edit
2. http://royalmechanicalbuzz.blogspot.in/2015/04/theory-of-machines-by-rs-khurmi-ebook-pdf.html
3. https://docs.google.com/file/d/0B5dLUIZfysmqMXBhakRyODhublU/edit
4. https://archive.org/details/theoryofmachines00mckarich

Course Home Page:

COMPUTATIONAL MECHANICAL ENGINEERING LABORATORY

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME106	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The courses should enable the students to:

I. Develop MAT LAB programs for simple and complex engineering problems.
II. Interpret the output graphical plots for the given governing equation.
III. Apply the MATLAB programming to real time applications.

LIST OF EXPERIMENTS

Week	Title
Week-1	**INTRODUCTION TO MATLAB**
Features of MATLAB.	
Week-2	**MATLAB**
Uses of MATLAB.	
Week-3	**MATLAB PROGRAM**
Analysis of kinematics in four bar mechanism.	
Week-4	**MATLAB PROGRAM**
Thermal stress analysis of Piston.	
Week-5	**MATLAB PROGRAM**
Formulation of ideal and real gas equations.	
Week-6	**MATLAB PROGRAM**
Dynamics and vibration analysis	
Week-7	**MATLAB PROGRAM**
Pipe flow analysis.	

Reference Books:

1. Delores M. Etter, David C. Kuncicky , Holly Moore, "Introduction to MATLAB 7", Pearson Education Inc, 1st Edition, 2009.
2. Rao. V. Dukkipati , "MATLAB for ME Engineers" , New Age Science, 1st Edition, 2008.
3. Agam Kumar Tyagi, "MATLAB and Simulink for Engineers", Oxford University Press 1st Edition, 2012.

Web References:

1. http://www.tutorialspoint.com/matlab/
2. http://in.mathworks.com/products/matlab/?requestedDomain=www.mathworks.com
3. http://www.iare.ac.in

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: MATLAB

HARDWARE: 36 numbers of Desktop Computer Systems

PRODUCTION TECHNOLOGY LABORATORY

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME107	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The courses should enable the students to:

I. Understand practical orientation of manufacturing processes.
II. Knowledge on different kinds of production processes and practices available for shaping or molding several daily used parts for industries.
III. Selection of equipments for various manufacturing processes will be understood.

LIST OF EXPERIMENTS

Week-1 PATTERN MAKING

Pattern design and making, casting drawing.

Week-2 SAND PROPERTIES TESTING

Sand properties testing for strengths and permeability.

Week-3 METAL CASTING

Moulding, melting and casting.

Week-4 ARC WELDING

ARC welding lap and butt joint.

Week-5 SPOT WELDING

Spot welding, TIG welding.

Week-6 PLASMA WELDING AND BRAZING

Plasma welding and brazing (water plasma device).

Week-7 APPLICATION OF SIMPLE AND COMPOUND DIE

Blanking and piercing, operation and study of simple, compound and progressive press tool.

Week-8 APPLICATION OF PROGRESSIVE DIE

Hydraulic press: deep drawing and extrusion operation.

Week-9 MECHANICAL PRESS WORKING

Bending and other operation.

Week-10	**PROCESSING OF PLASTICS**
Injection moulding.	
WeeK-11	**PROCESSING OF PLASTICS**
Blow moulding.	
Week-12	**BEYOND SYLLABUS**
1. MIG welding exercises. 2. Riveting of a plates.	
Week-13	**EXAMINATIONS**

Reference Books:

1. R. K. Jain, "Production Technology", Khanna Publishers, 18th Edition, 2013.
2. T. V. Ramana Rao, "Metal Casting", New Age, 1st Edition, 2010.
3. Philips Rosenthal, "Principles of Metal Castings", TMH, 2nd Edition, 2001.
4. B. S.Raghuwamshi, "A Course in Workshop Technology", Dhanpat Rai & Sons, 2014.
5. Kalpakjin S, "Manufacturing Engineering and Technology", Pearson Education, 7th Edition, 2014.
7. HMT, "Production Technology", McGraw-Hill Education, 1st Edition, 2013.

Web References:

1. http://www.iare.ac.in

Course Home Page:

LIST OF EQUIPMENTS REQUIRED FOR A BATCH 36 STUDENTS:

S.No	EQUIPMENT NAME	QUANTITY
1	Arc welding transformer with cables and holders	1
2.	Electric Furnace	1
3.	Spot welding Machine	1
4.	MIG welding machine	1
5.	Plasma welding	1
6.	TIG welding Machine	1
7.	Injection Moulding	1
8.	Blow Moulding	1
9.	Hydraulic press	1
10.	Wood Working Lathe	1
11.	Equipment for sand Testing	1
12.	Fly Wheel Press	1

LIST OF MATERIAL REQUIRED FOR A BATCH 36 STUDENTS:

S.No	DESCRIPTION	QUANTITY
1.	Wooden blocks 100x75x75 mm	36
2.	M.S Flat 30x25x3	1.8mts
3.	G.I Sheet 100x75x0.8	2 sheets
4.	Aluminium 100x75x3mm	2 sheets
5.	Moulding sand	50 kgs
6.	Bakelite Granules	25 kgs
7.	Aluminium Raw Material	10 kgs
8.	Welding Rods	2 Packets
9.	Oxy-Acetelene, Argon gas cylinders	1
10.	Filler wire(MIG) 18SWG	1

MECHANICS OF FLUIDS AND HYDRAULIC MACHINERY LABORATORY

IV Semester: ME									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME108	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The **courses should enable the students to:**

I. Understand the basic principles of fluid mechanics.
II. Apply Bernoulli equation for fluid flow.
III. Determine co-efficient of discharge.
IV. Evaluate the performance of hydraulic turbines.
V. Understand the functioning and characteristic curves of pumps.

LIST OF EXPERIMENTS

Week-1 VENTURIMETER

Determination of coefficient of discharge (C_d) and generation of various characteristic curves for water flowing through venturimeter

Week-2 ORIFICE METER

Determination of coefficient of discharge (C_d) and generation of various characteristic curves for water flowing through Orifice meter.

Week-3 PIPE FRICTION

Determination of friction factor for a given pipe line.

Week-4 BERNOULLI'S THEOREM

Verification of Bernoulli's theorem.

Week-5 IMPACT OF JET ON VANES

Determination of Impact of jet on various types of Vanes.

Week-6 PELTON WHEEL TURBINE

Performance test on Pelton wheel and generate various characteristic curves.

Week-7 FRANCIS TURBINE

Performance Test on Francis Turbine and generate various characteristic curves.

Week-8 KAPLAN TURBINE

Performance Test on Kaplan wheel and generate various characteristic curves.

Week-9 CENTRIFUGAL PUMP

Performance Test on Centrifugal Pump and generate various characteristic curves

Week-10	**MULTI-STAGE CENTRIFUGAL PUMP**
Performance Test on Multistage Centrifugal Pump and generate various characteristic curves	
WeeK-11	**RECIPROCATING PUMP**
Performance Test on Reciprocating Pump and generate various characteristic curves	
Week-12	**MINIOR LOSSES**
Determination of losses of head due to sudden contraction in a pipe line.	
Week-13	**EXAMINATIONS**
Reference Books:	
1. D.S. Kumar,"Fluid Mechanics and Fluid Power Engineering", Kotaria & Sons, Reprint, 2013. 2. D. Rama Durgaiah, "Fluid Mechanics and Machinery", New Age International, 1st Edition, 2002. 3. Banga, Sharma, "Hydraulic Machines", Khanna Publishers, 6th Edition, 2001. 4. Dr. R K Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 9th Edition, 2015.	
Web References:	
1.https://docs.google.com/document/d/1UaDrm0pnHgd8GnN7dAcXM6EikgqAD7BU-0d52VFZz1w/edit 2. http://www.iare.ac.in	
Course Home Page:	

LIST OF EQUIPMENTS REQUIRED FOR BATCH OF 36 STUDENTS:

S.No	EQUIPMENT NAME	QUANTITY
1	Impacts of jet on vanes	1 Nos
2	Venturimeter	1 Nos
3	Friction through a Pipe	1 Nos
4	Bernoulli's Apparatus	1 Nos
5	Centrifugal pump	1 Nos
6	Reciprocating Pump	1 Nos
7	Francis Turbine	1 Nos
8	Pelton Wheel	1 Nos
9	Kaplan Turbine	1 Nos
10	Stop watches	10 Nos
11	Tachometer	5 Nos

MACHINE TOOLS AND METROLOGY

V Semester: ME									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**			
AME010	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**	
		3	-	-	3	30	70	100	
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**			

OBJECTIVES:

The course should enable the students to:

I. Visualize the generation of surface profiles using the relative motion between directrix and generatrix.
II. Understand the basic mechanism involved in metal cutting processes using different cutting tools.
III. Understand the measurement of different attributes of metal cutting using various measuring instruments.
IV. Analyze surface topography, establish geometrical dimensioning and tolerancing.

UNIT-I	**BASIC MECHANISM OF METAL CUTTING**	**Classes: 09**

Elementary treatment of metal cutting theory, element of cutting process, geometry of single point tool and angles chip formation and types of chips, built up edge and its effects, chip breakers: Mechanics of orthogonal cutting, Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, machinability, tool materials.

UNIT-II	**MACHINE TOOL-I**	**Classes: 09**

Engine lathe, Principle, specification, types, work and tool holding devices, Automatic lathes, classification: Single spindle and multi-spindle automatic lathes and its tool layouts; Shaping, slotting and planning machines, Principles of working, specification, operations performed, Kinematic scheme.

UNIT-III	**MACHINE TOOL-II**	**Classes: 09**

Milling machine, classifications, specifications, working principles of milling machines; Geometry of milling cutters, methods of indexing, kinematic scheme of milling machines.

Drilling and boring machines, principles of working, specifications, types, operations performed, twist drill; Kinematics scheme of the drilling and boring machines.

UNIT-IV	**GEOMETRICAL DIMENSIONING AND TOLERANCES**	**Classes: 09**

Systems of Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types, unilateral and bilateral tolerance system, hole and shaft basis systems, Interchangeability and selective assembly; Linear Measurement: Slip gauges, dial indicator, micrometers; Measurement of angles and tapers: Bevel protractor, angle slip gauges, spirit levels, sine bar.

UNIT-V	**MEASURING INSTRUMENTS**	**Classes: 09**

Optical measuring instruments: Tool maker's microscope and its uses, collimators, optical projector, interferometer; Screw thread measurement: Element of measurement, errors in screw threads, measurement of effective diameter, angle of thread and thread pitch, profile thread gauges; Surface roughness measurement**:** Numerical assessment of surface finish: CLA, R.M.S Values, R_z values, methods of measurement of surface finish: profilograph, talysurf - ISI symbol for indication of surface finish.

Text Books:

1. Dr. R. Kesavan, Dr. R. Kesavan, "Machine Tools" Laxmi publications, 2nd Edition, 2016.
2. N. K Mehta**, "**Metal Cutting and Design of Cutting Tools, Jigs & Fixtures**",** McGraw-Hill Education, 1st Edition, 2014.
3. T. L. Chaudhary, "Metal Cutting and Mechanical Tool Engineering", Khanna Publishers, 5th Edition, 2013.
4. R. K. Jain, "Engineering Metrology", Khanna Publishers, 1st Edition, 2013.

Reference Books:

1. B.L. Juneja, G.S. Sekhon, Nitin Seth "Fundamentals of Metal Cutting and Machine Tools ", New Age Publishers, 2nd Edition, 2014.
2. Geofrey, "Fundamentals of metal machining and machine tools", Tata McGraw-Hill Education, 1st Edition, 2013.
3. R. S. Sirohi, H. C. Radha Krishna, "Mechanical Measurements", New Age Publishers, 3rd Edition, 2011.
4. M Mahajan "A Textbook of Metrology ", Dhanpatrai and Co, 2nd Edition, 2013.

Web References:

1. http://www.me.iitb.ac.in/~ramesh/courses/ME338/metrology1.pdf
2. http://www.mfg.mtu.edu/marc/primers/machtool/metrology.html3.
3. http://nptel.ac.in/courses/112106138.
4. https://en.wikipedia.org/wiki/Machine_tool.

E-Text Book:

1. http://ww.faadooengineers.com/threads/8474-Engineering-Metrology-Measurements-ppt-ebook-pdf-Download
2. http://www.yildiz.edu.tr/~meksi/index_dosyalar/MACHINE%20_TOOLS.pdf.

Course Home Page:

DYNAMICS OF MACHINERY

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME011	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to

I. Understand the concept of equilibrium for a body subjected to dynamic forces.
II. Apply the phenomenon of friction for automobile application.
III. Analyze the significance of governors and its application in turning moment diagram.
IV. Determine the fundamental frequency of mechanical systems.

UNIT-I	PRECESION, STATIC AND DYNAMIC FORCE ANALYSIS OF PLANAR MECHANISMS	Classes : 09

Precession: Gyroscopes, effect of processional motion on the stability of moving vehicles such as motor car, motor cycle, aero-planes and ships, static and dynamic force analysis of planar mechanisms: (Neglecting friction), Introduction to free body diagrams, conditions of equilibrium, two and three force members, inertia forces and D'Alembert's principle, planar rotation about a fixed centre.

UNIT-II	CLUTCHES, BRAKES AND DYNAMOMETERS	Classes : 09

Clutches: Friction clutches, Single disc or plate clutch, multiple disc clutches, cone clutch and centrifugal clutch; Brakes and dynamometers: Simple block brakes, internal expanding brake, band brake of vehicle; Dynamometers absorption and transmission types, general description and method of operation.

UNIT-III	TURNING MOMENT AND GOVERNORS	Classes: 09

Turning moment diagrams and flywheels: turning moment: Inertia torque, angular velocity and acceleration of connecting rod, crank effort and torque diagrams, fluctuation of energy; Design of flywheels.

Governors: Watt, Porter and Proell governors, spring loaded governors, Hartnell and Hartung with auxiliary springs, sensitiveness, isochronism and hunting.

UNIT-IV	BALANCING OF ROTATORY AND RECIPROCATING MASSES	Classes: 09

Balancing: Balancing of rotating masses, single and multiple-single and different planes-balancing of reciprocating masses, primary and secondary balancing-analytical and graphical methods; unbalanced forces and couples: Balancing of V-engines, multi cylinder, inline and radial engines for primary, secondary balancing and locomotive balancing.

UNIT-V	MECHANICAL VIBRATIONS	Classes : 09

Vibrations: Free vibration of mass attached to a vertical spring, simple problems on forced damped vibration; Vibration isolation and transmissibility, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

Text Books:

1. Thomas Bevan, "Theory of Machines", Pearson Education, 3rd Edition, 2009.
2. S.S Ratan, "Theory of Machines", Tata McGraw-Hill, 4th Edition, 2014.
3. R. L. Norton, "Kinematics and Dynamics of Machinery", McGraw-Hill, 1st Edition, 2009.
4. P.L. Balleny, "Theory of Machines and Mechanisms", Khanna publishers, 2013.

Reference Books:
1. J. S. Rao, R.V. Dukkipati, “Mechanism and Machine Theory”, New Age Publication, 1st Edition, 2013. 2. Uiker, Penock, Shigley, “Theory of Machines and Mechanisms”, Oxford University Press, 4th Edition, 2013. 3. R.S. Khurmi, Guptha, “Theory of Machines”, S.Chand & Co, New Delhi, 14th Edition, 2013.
Web References:
1. http://nptel.ac.in/courses/112104114/ 2. http://elearning.vtu.ac.in/newvtuelc/courses/17/e-Notes/10ME54/Unit1-SRJ.pdf
E-Text Book:
1. http://royalmechanicalbuzz.blogspot.in/2015/04/theory-of-machines-by-rs-khurmi-ebook-pdf.html 2. http://www.faadooengineers.com/threads/32367-Theory-of-Machine-by-SS-Rattan-pdf-free-download
Course Home Page:

DESIGN OF MACHINE MEMBERS

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME012	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand design and analysis of load transmitting elements and selection of suitable materials and manufacture of these components.
II. Analyze the forces acting on various components and their design.
III. Apply theories of failure and select optimum design size for various machine elements.
IV. Understand the need for joints and their application for different purposes in transmission of static loads.

UNIT-I **FUNDAMENTELS OF MACHINE DESIGN** **Classes : 09**

Introduction: General considerations in the design of engineering materials and their properties, selection, manufacturing consideration in design, tolerances and fits, BIS codes of steels; Theories of failures, factor of safety design for strength and rigidity, preferred number; Fatigue loading : Stress concentration, theoretical stress concentration factor, fatigue stress concentration factor, notch sensitivity, design for fluctuating stresses, endurance limit, estimation of endurance strength, Goodman's life, Soderberg's line.

UNIT-II **DESIGN OF FASTENERS AND WELDED JOINTS** **Classes : 09**

Design of fasteners: Riveted joints, methods of failure of riveted joints, strength equations, efficiency of riveted joints, eccentrically loaded riveted joints; Welded Joints: Design of fillet welds, axial loads, circular fillet welds, bending, bolts of uniform strength.

UNIT-III **DESIGN OF KEYS, COTTERS AND KNUCKLE JOINTS** **Classes: 09**

Keys, cotters and knuckle joints: Design of keys, stress in keys.

Cotter joints, spigot and socket, sleeve and cotter, jib and cotter joints, Knuckle joints.

UNIT-IV **DESIGN OF SHAFTS AND SHAFT COUPLINGS** **Classes: 09**

Design of Shafts: Design of solid and hollow shafts for strength and rigidity, design of shafts for complex loads, Shaft sizes, BIS code, design of shafts for gear and belt drives; Shaft couplings: Rigid couplings, muff, Split muff and flange couplings, flexible couplings, pin, bush coupling.

UNIT-V **DESIGN OF MECHANICAL SPRINGS** **Classes : 09**

Mechanical Springs: Stresses and deflections of helical springs, extension compression springs, springs for static and fatigue loading, natural frequency of helical springs, energy storage capacity, helical torsion springs, co-axial springs.

Text Books:

1. P. Kannaiah, "Machine Design", 2nd Edition, Scitech Publications India Pvt. Ltd, New Delhi, 2012.
2. V.B. Bandari, "A Text Book of Design of Machine Elements", 3rd Edition, Tata McGraw-Hill, 2011.

Reference Books:

1. Richard G. Budynas, J. Keith Nisbett, "Shiegly's Mechanical Engineering Design", 10th Edition, 2014.
2. S. Md. Jalaluddine, "Machine Design", Anuradha Publishers, 1st Edition, 2004.
3. R.L. Norton, "Machine Design-An Integrated approach", Person Publisher, 2nd Edition, 2006.
4. U.C. Jindal, "Machine Design", Pearson, 1st Edition, 2010.
5. T. Krishna Rao, "Design of Machine Elements", I.K International Publishing House, 2nd Edition, 2011.
6. R.S. Khurmi, A. K. Gupta, "Machine Design", S. Chand & Co, New Delhi, 1st Edition, 2014.
7. PSG College, "Design Data: Data Book of Engineers", 1st Edition, 2012.

Web References:

1. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/New_index1.html
2. http://www.nptel.ac.in/downloads/112105125/
3. http:/www.alljntuworld.in/download/design-machine-members-1-dmm-1-materials-notes/
4. http://www.scoopworld.in/2015/03/design-of-machine-members-dmm-mech.html

E-Text Book:

1. http://www.faadooengineers.com/threads/26687-Machine-design-by-shigley-ebook-download-pdf
2. http://www.freepdfbook.com/design-of-machine-elements-by-v-b-bhandari/
3. http:/www.only4engineer.com/2014/10/a-textbook-of-machine-design-by.html
4. http:/www.engineering108.com/Data/.../Handbooks/machine_design_databook.pdf

Course Home Page:

THERMAL ENGINEERING

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME013	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the working of steam, gas power plant operating cycle and performance of critical components, accessories.

II. Estimate the calorific value of various fuels using volumetric-gravimetric analysis.

III. Visualize the advanced gas jet propulsion systems and their effects.

UNIT-I	BASIC CONCEPTS OF RANKINE CYCLE	Classes : 09

Rankine cycle schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance, regeneration and reheating. Combustion: fuels and combustion, adiabatic flame temperature, stoichiometry, flue gas analysis.

UNIT-II	BOILERS AND STEAM NOZZLES	Classes : 09

Boilers: Classification, working principles with sketches including, high pressure boilers, mountings and accessories, working principles, steam nozzles: Function of nozzle, applications, types, flow through nozzles, thermodynamic analysis.

UNIT-III	STEAM TURBINES AND CONDENSERS	Classes: 09

Steam turbines: Classification, impulse turbine, mechanical details, velocity diagram, effect of friction, power developed, axial thrust, blade or diagram efficiency, condition for maximum efficiency; Reaction turbine: Mechanical details, principle of operation, thermodynamic analysis of a stage, degree of reaction, velocity diagram, Parson's reaction turbine, condition for maximum efficiency.

Steam condensers: Requirements of steam condensing plant, classification of condensers, working principle of different types.

UNIT-IV	GAS TURBINES	Classes: 09

Gas turbines: Simple gas turbine plant, ideal cycle, essential components, parameters of performance, actual cycle, regeneration, inter cooling and reheating, closed and Semi-closed cycles, merits and demerits, brief concepts of compressors combustion chambers and turbines of gas turbine plant.

UNIT-V	JET PROPULSION AND ROCKETS	Classes : 09

Jet propulsion: Principle of operation, classification of jet propulsive engines, working Principles with schematic diagrams and representation on T-S diagram, thrust, thrust power and propulsion efficiency, turbo jet engines, needs and demands met by turbo jet, schematic diagram, thermodynamic cycle, performance evaluation thrust augmentation methods; Rockets: Application, working Principle, classification, propellant type, thrust, propulsive efficiency, specific impulse, solid and liquid propellant rocket engines.

Text Books:

1. R. K. Rajput, "Thermal Engineering", Lakshmi Publications, 8th Edition, 2015
2. V. Ganeshan, "Gas turbines", Tata McGraw-Hill, 3rd Edition, 2010.

Reference Books:
1. P. Khajuria, S. P Dubey, "Gas Turbines and Propulsive systems", Dhanpat Rai Publishers., 1st Edition, 2012. 2. Ballaney, "Thermal Engineering", Khanna Publishers, 1st Edition, 2012. 3. R. Yadav, "Thermodynamics and Heat Engines", Central Book Depot, 1st Edition, 2002.
Web References:
1. https://en.wikipedia.org/wiki/Thermodynamics 2. http://www.livescience.com/50776-thermalengineering.html
E-Text Book:
1. http://www.ebookdownloadz.net/2014/08/ Thermal engineering -by-R.K Rajput.html
Course Home Page:

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS015	Skill	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the market dynamics namely demand and supply, demand forecasting, elasticity of demand and supply, pricing methods and pricing in different market structures.
II. Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis.
III. Analyze how capital budgeting decisions are carried out.
IV. Develop an understanding of the frame work for both manual and computerized accounting process.
V. Know how to analyze and interpret the financial statements through ratio analysis.

UNIT-I	INTRODUCTION AND DEMAND ANALYSIS	Classes : 07

Definition, nature and scope of business economics. Demand analysis: Demand determinants, law of demand and its exceptions. Elasticity of demand: Definition, types, measurement and significance of elasticity of demand. Demand forecasting, factors governing demand forecasting.

UNIT-II	PRODUCTION AND COST ANALYSIS	Classes : 10

Production function-isoquants and isocosts, MRTS, least cost combination of inputs, cobb-dougles production function, internal and external economies of scale, cost analysis: Cost concepts. Break even analysis (BEA)-determination of break-even point (simple problems)-managerial significance and limitations.

UNIT-III	MARKETS AND NEW ECONOMIC ENVIRONMENT	Classes: 08

Types of competition and markets, features of perfect competition, monopoly and monopolistic competition, price-output determination in case of perfect competition and monopoly.

Business: Features and evaluation of different forms of business organization: Sole proprietorship, partnership, joint stock company, public enterprises and their types.

UNIT-IV	CAPITAL BUDGETING	Classes: 10

Capital and its significance, types of capital, estimation of fixed and working capital requirements, methods and sources of raising capital- capital budgeting: features of capital budgeting proposals, methods of capital budgeting: payback period, accounting rate of return(ARR), net present value method and internal rate of return method (simple problems).

UNIT-V	INTRODUCTION TO FINANCIAL ACCOUNTING & FINANCIAL ANALYSIS	Classes : 10

Financial accounting objectives, functions, importance; Accounting concepts and accounting conventions -double-entry book keeping, journal, ledger, trial balance-final accounts (Trading account, Profit & Loss account and Balance Sheet with simple adjustments). Financial analysis: Analysis and interpretation of liquidity ratios, activity ratios, capital structure ratios and profitability ratios, Du pont chart.

Text Books:
1. Aryasri, “Managerial Economics and Financial Analysis”, Tata McGraw-Hill, 2012. 2. M. Kasi Reddy, Saraswathi, “Managerial Economics and Financial Analysis”, PHI, New Delhi, 2012. 3. Varshney, Maheswari, “Managerial Economics”, Sultan Chand & Co, New Delhi, 2009.
Reference Books:
1. S. A. Siddiqual, A. S. Siddiqual, “Managerial Economics and Financial Analysis”, New Age International Publishers, Hyderabad, 2013. 2. S. N. Maheswari, S. K. Maheswari, “Financial Accounting”, Vikas, 2012. 3. J. V. Prabhakar Rao, P. V. Rao, “Managerial Economics and Financial Analysis”, Maruthi Publishers, 2011. 4. Vijay Kumar, Appa Rao, “Managerial Economics and Financial Analysis”, Cengage 2011.
Web References:
1. https:// www.scribd.com/doc/37684926 2. https:// www.slideshare.net/glory1988/managerial-economics-and- financial analysis 3. http:// www.cs.utah.edu/~devnani/2-2.pdf 4. https:// thenthata.web4kurd.net/mypdf/managerial-economics-and- financial analysis 5. https:// bookshallcold.link/pdfread/managerial-economics-and-financial analysis 6. https:// www.gvpce.ac.in/syllabi/Managerial Economics and financial analysis
E-Text Book:
1. https:// books.google.co.in/books/about/Managerial economics and financial analysis 2. http://www. ebooktake.in/pdf/title/managerial-economics-and-financial analysis 3. http://all4ryou.blogspot.in/2012/06/mefa-managerial-economics and financial analysis 4 http://books.google.com/books/about/Managerial economics and financial analysis 5. http://www.scribd.com/doc/37684926
Course Home Page:

RESEARCH AND CONTENT DEVELOPMENT

V Semester: AE / CSE / IT / ECE / EEE / MECH								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS106	**Skill**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	2	1	30	70	100

OBJECTIVES:

The course should enable the students to:

I. Gain a practical understanding of the various methodological tools used for social scientific research.
II. Learn the ethical, political, and pragmatic issues involved in the research process.
III. Improve their ability to develop technical writing.
IV. Identify the overall process of designing a research study from its inception to its report.

Week - l, 2, 3	**LATEX FOR DOCUMENTATION**

Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check and Track Changes using LaTeX; Mathematical expressions, Subscripts and superscripts, brackets and parentheses, fractions and binomials, aligning equations, operators, spacing in math mode, integrals, sums and limits, display style in math mode, list of Greek letters and math symbols, mathematical fonts; Prepare class timetable and student marks list using LaTex;

Week - 4	**RESEARCH FORMULATION AND DESIGN**

1. Topic/Title Selection for Research and Problem Statement
2. Title Selection and / or Methodology Formulation
3. Finalization of tentative Methodology

Week - 5	**DATA COLLECTION**

Data Preparation: Data Generation (simulated data) or Collection of Real Data – Part: I

Week - 6	**DATA COLLECTION AND SAMPLING DESIGN**

Data Preparation: Data Generation (simulated data) or Collection of Real Data – Part: II

Week – 7	**IMPLEMENTATION**

Implementation of Methodology on the Data and discussion of results - Part: I

Week – 8	**IMPLEMENTATION**

Implementation of Methodology on the Data and discussion of results - Part: II

Week – 9	**IMPLEMENTATION OF METHODOLOGY**

1. Block diagram / flowchart of Methodology or Algorithm
2. Testing of Methodology / algorithm, discussion of Results

Week – 10	**RESULTS**

Evaluation of Methodology / Algorithm, Discussion or Results and conclusion

Week – 11	**PLAGIARISM ANALYSIS**

Documentation / Paper formatting of Review / Research Article – Part: I (Plagiarism analysis)

Week – 12	DOCUMENTATION
Documentation / Paper formatting of Review / Research Article – Part: II (Paper ready for submission)	

Text Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, “An Introduction to Research Methodology”, RBSA Publishers. U.K., 2002.
2. Kothari, C.R, “Research Methodology: Methods and Techniques”. New Age International. 418p, 1990.
3. Stefan Kottwitz , “ LATEX Beginner’s Guide”, Packt Publishing Limited, 2011.

Reference Book:

1. Meenakshi Raman, Sangeeta Sharma, “Technical Communication”, Oxford Publishers, 1st Edition, 2004.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

Web References:

1. https://www.techwhirl.com/what-is-technical-writing/
2. https://www.mit.edu/me-ugoffice/communication/technical-writing
3. https://www.vocabulary.com/dictionary/technical

E-Text Books:

1. www.ebooksgo.org/
2. www.e-booksdirectory.com

THERMAL ENGINEERING LABORATORY

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME109	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The courses should enable the students to:

I. Visualize the cycle timings of S.I and C.I engines.
II. Determine performance characteristics of C.I and S.I engines
III. Differentiate between water tube and fire tube boilers.
IV. Estimate the importance of multi-staging of air compressors.

LIST OF EXPERIMENTS

Week-1	**IC Engines Valve/Port timing diagram**
Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.	
Week-2	**IC Engine performance test for 4-stroke SI Engine**
Performance test for 4-stroke SI engine and draw performance curves	
Week-3	**IC Engine performance test for 2-stroke SI Engine**
Determination of volumetric efficiency and break thermal efficiency.	
Week-4	**IC Engines Morse, retardation and motoring test**
Determination of frictional power of IC engine.	
Week-5	**IC Engines heat balance-CI/SI engines**
Balancing of heat losses and heat input in SI/CI engines	
Week-6	**IC Engines economical speed test on SI Engine**
Performance Test on SI engine with speed as a parameter	
Week-7	**IC Engines effect of Air/Fuel ration in a SI engine**
Calculating air/fuel ratio of a 4-stroke SI Engine	
Week-8	**Performance test on Variable Compression Ratio(VCR) engine**
Performance Test on CI engine when the compression ratio is changing.	
Week-9	**IC Engine performance test on 4-Stroke CI engine**
Performance Test on 4-stroke CI engine and to draw the performance curves	
Week-10	**Volumetric Efficiency of Reciprocating Air compressor unit**
Performance of air compressor unit	

WeeK-11	**Disassembly/Assembly of Engines**
Awareness of components of given IC engine and assembling /disassembling of parts.	
Week-12	**Study of Boilers**
To study the working operation of different types of boilers.	
Week-13	**Examinations**

Reference Books:

1. V. Ganesan, "I.C. Engines", Tata McGraw-Hill, 3rd Edition, New Delhi, India. 2011.
2. B. John Heywood, "Internal combustion engine fundamentals", Tata McGraw-Hill, 2nd Edition, New Delhi. 2011
3. R. K. Rajput , "Thermal Engineering", Lakshmi Publications, 18th Edition, 2011.

Web References:

1 https://en.wikipedia.org/wiki/Internal_combustionengines.
2.https://en.wikipedia.org/wiki/Compression_Ignitionengines

Course Home Page:

LIST OF EQUIPMENTS REQUIRED FOR BATCH OF 36 STUDENTS:

S.No	Equipment Name	Quantity
1	Vcr4 stroke diesel engine test rig	1
2	Two stage reciprocating air compressor	1
3	Boiler models	1
4	Two stroke engine test rig	1
5	4 stroke single cylinder petrol engine test rig	1
6	Refrigeration cycle test rig	1
7	Multi-cylinder fiat engine (assembly and disassembly)	1
8	Cut section of petrol engine	1
9	Cut section diesel engine	1
10	Single cylinder diesel engine test rig	1
11	Four stroke multi-cylinder engine	1

LIST OF CONSUMABLES REQUIRED FOR A BATCH OF 36 STUDENTS

S.No	Consumable Name	Quantity
1.	Petrol	2lts
2.	Diesel	2lts
3.	LPG	1 Cylinder

MACHINE TOOLS AND METROLOGY LABORATORY

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME110	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 39**				**Total Classes: 39**		

OBJECTIVES:

The courses should enable the students to:

I. Hands on experience on lathe machine to perform turning, facing, threading operations.
II. Practical exposure on flat surface machining, milling and grinding operations.
III. Skill development in drilling and threading operations.
IV. Linear and angular measurements exposure.
V. Create awareness on various mechanical measuring instruments.
VI. Familiarize with various operations on machine tools.

LIST OF EXPERIMENTS

Week	Experiment
Week-1	**LATHE MACHINE**
Step turning, taper turning, Thread cutting and knurling using lathe machine	
Week-2	**DRILLING AND STEP BORING**
Drilling, tapping and step boring using drilling machine.	
Week-3	**PLANNING AND SHAPING**
Shaping of V-groove using shaper.	
Week-4	**SLOTTING**
Slotting of a keyway using slotter machine.	
Week-5	**MILLING AND SURFACE GRINDING**
Milling of gear and surface grinding.	
Week-6	**VERNIER CALIPERS AND MICROMETER**
Length, depth, diameter measuring using vernier calipers and micrometer.	
Week-7	**SCREW THREAD MEASUREMENT**
Screw thread measurement by three wire method.	
Week-8	**SURFACE ROUGHNESS MEASUREMENT**
Surface roughness by talysurf.	

Week-9	**BORE GAUGE**
Bore measurement using bore gauge.	
Week-11	**GEAR TEETH CALIPER/MICROMETER**
Use of gear teeth caliper for checking the chordal addendum and chordal height of spur gear.	
WeeK-12	**TOOL ANGLES AND TAPER MEASUREMENTS**
Tool angles and taper measurements using bevel protractor, sine bar, slip gauges, Tool Maker's microscope.	
Week-13	**REVIEW**
Spare session for additional repetitions and review.	
Week-14	**EXAMINATIONS**

Reference Books:

1. B. S. Raghu Vamshi, "Workshop Technology Vol – II", 9th Edition, Dhanpat Rai Publishers, New Delhi, India. 2010.
2. H.M.T. (Hindustan Machine Tools), "Production Technology", Tata McGraw-Hill Education (P) Ltd, New Delhi, India, 2nd Edition, 1980.
3. Jain R.K., "Engineering Metrology", Khanna Publishers, 1st Edition, 2005.
4. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 1st Edition, 2006.

Web References:

1. https://www.ocw.mit.edu/courses/mechanical-engineering/
2. http://www.nptel.ac.in/courses/112106138/
3. http://www.nptel.ac.in/courses/112106139/
4. http://www.nptel.ac.in/courses/112105126/

Course Home Page:

LIST OF EQUIPMENTS REQUIRED FOR BATCH OF 36 STUDENTS:

S. No	Equipment Name	Quantity
1.	Vernier Calipers	1
2.	Screw gauge	6
3.	Vernier height gauge	1
4.	Tool maker’s microscope	1
5.	Bevel protractor	1
6.	Sine bar and gauges	1
7.	Dial bore indicator	1
8.	Dial gauge	2
9.	Lathe machine and accessories	13
10.	Milling machine and accessories	2
11	Slotting machine	1
12	Shaping machines	1
13	Drilling machines	2
14	Surface grinding machines	1
15	Tool and cutter grinding	1
15	Cylindrical grinding machine	1
16	Gear tooth micrometer	1
17	Vernier depth gauge	1
18	Surface plate	1
19	Planning machine	1
20	Power hacksaw	1

LIST OF CONSUMABLES REQUIRED FOR A BATCH OF 36 STUDENTS

S. No	Consumable Name	Quantity
1.	MS Rod (Dia20)	10 mts
2.	MS Flat (50mm x 25mm thickness)	3 mts
3.	Aluminium hollow blank (60mm dia x 50mm dia x 20mm thick)	1.5 mts
4.	Standard test specimens for metrology	As required
5.	Standard Cutting tools	As required
6.	Standard cutting inserts	As required
7.	Grinding Wheel	As required
8.	Cutting oil (Servo cut S)	20 lts
9.	Gear box oil	50 lts
10.	Lubricating oil	10 lts
11	Grease	1kg
12	Cotton waste	30 kg

FINITE ELEMENT MODELLING

VI Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME014	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Select and apply numerical methods to solve engineering problems.
II. Discretize the given continuum and problem formulation using constitutive relations.
III. Apply FEM techniques to solve engineering problems (both vector and scalar) involving various fields for design, analysis and optimization.
IV. Understand to refine the approximate solution by spending more computational effort by using higher order interpolation continuities.

UNIT-I	INTRODUCTION TO FEM	Classes : 09

Introduction to fem for solving field problems, basic equations of elasticity, stress–strain and strain-displacement relations for 2D-3D elastic problems, boundary conditions, one dimensional problem, finite element modeling coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, quadratic shape functions.

UNIT-II	ANALYSIS OF TRUSSES AND BEAMS	Classes : 09

Analysis of trusses stiffness matrix for plane truss elements, stress calculations and problems analysis of beams: element stiffness matrix for two nodes, two degrees of freedom per node beam element and simple problems.

UNIT-III	2-D ANALYSIS	Classes: 09

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, estimation of load vector, stresses.

Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements, two dimensional four noded iso parametric elements.

UNIT-IV	STEADY STATE HEAT TRANSFER ANALYSIS	Classes: 09

Steady state heat transfer analysis: 1-D heat conduction of slab 1D fin elements, 2D heat conduction, analysis of thin plates, analysis of a uniform shaft subjected to torsion, problems.

UNIT-V	DYNAMIC ANALYSIS	Classes : 09

Dynamic analysis: Dynamic equations, lumped and consistent mass matrices, eigen values and eigen vectors for a stepped bar, beam; Finite element, formulation to 3D problems in stress analysis, convergence requirements, mesh generation, techniques such as semi automatic and fully automatic use of software such as ANSYS, NISA, NASTRAN.

Text Books:

1. Tirupathi K., Chandrapatla, Ashok D. Belagundu, "Introduction to Finite Elements in Engineering", 1st Edition, 2013.

2. S. S. Rao, “The Finite Element Methods in Engineering”, Elsevier, 4th Edition, 2013.
3. J. N. Reddy, “An Introduction to Finite Element Methods”, McGraw-Hill, 1st Edition, 2013.

Reference Books:

1. Alavala, “Finite Element Methods”, TMH, 1st Edition, 2012.
2. O.C. Zienkowitz, “The Finite Element Method in Engineering Science”, McGraw-Hill, 1st Edition, 2013.
3. Robert Cook, “Concepts and Applications of Finite Element Analysis”, Wiley, 1st Edition, 2013.
4. S. Md. Jalaludeen, “Introduction of Finite Element Analysis”, Anuradha publications, 1st Edition, 2010.

Web References:

1. http://nptel.ac.in/courses/112104116/
2. http://nptel.ac.in/courses/112104116/
3. http://nptel.ac.in/courses/112104116/ui/TableofContents.html

E-Text Books:

1. https://www.google.co.in/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-#q=fem%20notes
2. https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved
3. http://kth.se/social/upload/5261b9c6f276543474835292/main.pdf
4. http://engineeringstudymaterial.net/tag/finite-element-analysis-books/
5. http://www.faadooengineers.com/threads/8846-FINITE-ELEMENTS-METHODS-ebook-pdf
6. https://themechangers.blogspot.in/2013/08/ebook-finite-element-method-in.html

Course Home Page:

MACHINE DESIGN

VI Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME015	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Design and analyze the power transmitting elements.
II. Apply the theories of failures and design optimization procedures using strength and stiffness criteria.
III. Select the bearings for industrial applications using design data hand book.
IV. Comprehend the principles of standardization and interchangeability.

UNIT-I	DESIGN OF BEARINGS	Classes : 09

Bearings: Types of journal bearings, basic modes of lubrication, bearing modulus, full and partial bearings, clearance ratio, heat dissipation of bearings, bearing materials, journal bearing design, ball and roller bearing, Static load, dynamic load, equivalent radial load-design and selection of ball and roller bearings.

UNIT-II	DESIGN OF IC ENGINE PARTS	Classes : 09

Connecting rod: thrust in connecting rod, stress due to whipping action on connecting rod ends; Cranks and crank shafts: strength and proportions of over hung and center cranks, crank pins, crank shafts; Piston: Forces acting on piston, construction design and proportions of piston.

UNIT-III	POWER TRANSMISSION SYSTEMS, PULLEYS	Classes: 09

Power transmission systems, pulleys: Transmission of power by belt and rope drives, transmission efficiencies; Belts, flat and V-belts.

Ropes: Different types of ropes, selection of ropes; Pulleys for belt and rope drives, materials, chain drives.

UNIT-IV	DESGIN OF GEARS	Classes: 09

Spur gear**:** Load concentration factor, dynamic load factor, surface compressive strength, bending strength, design analysis of spur gear, check for plastic deformation, check for dynamic and wear considerations; Helical and bevel gear drives: Load concentration factor, dynamic load factor, analysis of helical and bevel gears, check for plastic deformation, check for dynamic and wear considerations; Design of worm gears: worm gear, properties of worm gears, selections of materials, strength and wear rating of worm gears, force analysis, friction in worm gears, thermal considerations.

UNIT-V	DESIGN OF POWER SCREWS	Classes : 09

Design of power screws: Design of screw, design of nut, compound screw, differential screw, ball screw, possible failures.

Text Books:

1. Shigley, J. E, "Mechanical Engineering Design", Tata McGraw-Hill, 9th Edition, 2011.
2. V. B. Bandari, "A Text Book of Design of Machine Elements", Tata McGraw-Hill, 3rd Edition, 2011.
3. S. M. D. Jalaludin, "Machine Design", Anuradha Publishers, 3rd Edition, 2011.

Reference Books:

1. P. Kannaiah, “Machine Design”, Scitech Publications, 2nd Edition, 2012
2. L. Norton, “Machine Design”, Pearson Publishers, 2nd Edition, 2012
3. Dr Sadhu singh, “Machine design”, Khanna publishers, 1st Edition, 2009.
4. P.C. Sharma, D.K. Agrawal, “Machine Design”, S. K. Kataria & Sons Publishers, 1st Edition, 2010.
5. George Dieter, Linda C. Schmidt, “Engineering design”, McGraw-Hill, 5th Edition, 2013.
6. S.G. Kulkarni, “Machine Design”, Tata McGraw-Hill, 1st Edition, 2013.

Web References:

1. http://nptel.ac.in/courses/112106137/#
2. http://gradestack.com/gate-exam/mechanical-engineering/machine-design/
3. http://studentskey.in/design-of-machine-elements-notes/
4. http://www.mechcareer.in/study-material/machine-design/
5. https://www.studynama.com/community/threads/308-Machine-Design-1-lecture-notes-ebook-pdf-download-for-ME-engineers

E-Text Book:

1. http://www.mechanicalgeek.com/machine-design-rs-khurmi-pdf/
2. http://www.azshiksha.com/ebook/engineering/me/design_of_machine_elements_by_v_b_bhandari.p
3. http://www.allexamresults.net/2015/11/Design-of-Machine-Elements-by-V-B-Bhandari-ebook-Free-Download.html
4. http://machinedesign.com/learning-resources/ebooks

Course Home Page:

HEAT TRANSFER

<table>
<tr><td colspan="10">VI Semester: ME</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AME016</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 15</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 60</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Understand the basic modes of heat transfer and deduce its governing equations.
II. Comprehend the heat transfer coefficient and constants.
III. Visualize the emission phenomenon.
IV. Apply the heat transfer concept to heat exchangers.
V. Familiarize heat transfer data hand book.

UNIT-I	BASIC CONCEPTS	Classes : 09

Modes and mechanisms of heat transfer, basic laws of heat transfer, applications of heat transfer; conduction heat transfer: Fourier rate equation, general three dimensional heat conduction equations in cartesian, cylindrical and spherical coordinates; Simplification and forms of the field equation**,** steady and unsteady and periodic heat transfer, initial and boundary conditions

UNIT-II	ONE DIMENSIONAL STEADY STATE AND TRANSIENT CONDUCTION HEAT TRANSFER	Classes : 09

One dimensional steady state conduction heat transfer: Homogeneous slabs, hollow cylinders and spheres, overall heat transfer coefficient, electrical analogy, Critical radius of insulation; one dimensional steady state conduction; heat transfer: with variable thermal conductivity and systems with internal heat generation, extended surfaces (Fins) long, short and insulated tips; one dimensional transient heat conduction: Systems with negligible internal resistance, significance of Biot and Fourier numbers, chart solutions of transient conduction systems.

UNIT-III	CONVECTIVE HEAT TRANSFER	Classes: 09

Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow, dimensional analysis as a tool for experimental investigation, Buckingham Pi Theorem and method, application for developing semi, empirical non-dimensional correlation for convection heat transfer, significance of non dimension numbers, concepts of continuity, momentum and energy equations;

Forced convection: external flows: Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer, flat plates and cylinders; Internal flows, Concepts about Hydrodynamic and thermal entry lengths, division of internal flows based on this, use of empirical correlations for horizontal pipe flow and annulus flow; free convection: Development of hydrodynamic and thermal boundary layer along a vertical plate, use of empirical relations for vertical plates and pipes.

UNIT-IV	HEAT TRANSFER WITH PHASE CHANGE	Classes: 09

Boiling: Pool boiling- regimes Calculations on Nucleate boiling, Critical heat flux, Film boiling; Condensation: Film wise and drop wise condensation, Nusselt’s theory of condensation on a vertical plate Film condensation on vertical and horizontal cylinders using empirical correlations; Radiation heat transfer: Emission characteristics, laws of black-body radiation, Irradiation, total and Monochromatic quantities, laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann, heat exchange between two black bodies, concepts of shape factor, emissivity, heat exchange between grey bodies, radiation shields, electrical analogy for radiation networks.

UNIT-V	HEAT EXCHANGERS	Classes : 09
Classification of heat exchangers, overall heat transfer Coefficient and fouling factor, Concepts of LMTD and NTU methods, Problems using LMTD and NTU methods.		
Text Books:		
1. Yunus A. Cengel , "Heat Transfer a Practical Approach", Tata McGraw-Hill education (P) Ltd, New Delhi, 4th Edition, 2012. 2. R. C. Sachdeva, "Fundamentals of Engineering, Heat and Man Transfer", New Age, New Delhi, 3rd Edition, 2012.		
Reference Books:		
1. Holman, "Heat Transfer", Tata McGraw-Hill education, 10th Edition, 2011. 2. P. S. Ghoshdastidar, "Heat Transfer", Oxford University Press, 2nd Edition, 2012. 3. Incropera, Dewitt, "Fundamentals of Heat Transfer", John Wiley, 6th Edition, 2012. 4. D. S. Kumar, "Heat and Mass Transfer", S.K. Kataria & sons, 9th Edition 2015.		
Web References:		
1. https://en.wikipedia.org/wiki/Heat_Transfer 2. https://en.wikipedia.org/wiki/Heat and Mass Transfer		
E-Text Book:		
1. https://www3.nd.edu/~powers/ame.20231/cengel.pdf 2. http://www.ebookdownloadz.net/2014/08/heat transfer -by-rajput.html		
Course Home Page:		

IDEATION AND PRODUCT DEVELOPMENT

VI Semester: Common for all branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME201	Skill	L	T	P	C	CIA	SEE	Total
		0	0	2	1	30	70	100
Contact Classes:	Tutorial Classes:	Practical Classes: 28				Total Classes: 28		

OBJECTIVES:

The course should enable the students:

- **I.** To develop next generation Entrepreneurs and Creative Leaders to resolve live challenges.
- **II.** To understand about the future needs of industries.
- **III.** To transform innovative ideas into successful businesses.
- **IV.** To use a range of creative thinking tools to develop Out of the Box Ideas.
- **V.** To develop Breakthrough Innovators and Dynamic Thinkers.

Syllabus

- Successful team formation and management
- Introduction to user-centred design
- Ideation and use of personas and POVs
- Need finding
- Embedded Microcontrollers for consumer products
- Human factors in engineering design
- Critical Experience and Critical Function Prototyping
- Dark Horse and 'Funky' prototyping
- Rapid prototyping and manufacturing
- Design for manufacture
- User testing
- Use of video/electronic media for communication
- Start-ups and entrepreneurship
- Intellectual Property

Text Books:

1. Product Design: Techniques in Reverse engineering & New Product development. K Otto & K Wood. Prentice Hall, 2001. ISBN 0-13-0212271-7 TCD Shelf Mark. HL-236-568.
2. Invention by design: how engineers get from thought to thing, Petroski H. Cambridge, Mass., London, Harvard University Press, 1996. ISBN 0674463676. TCD Shelf Mark. HL-201-280.
3. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Tim Brown, Harper Business, 2009, ISBN 978-0061766084.
4. Creative Confidence: Unleashing the Creative Potential Within Us All, Tom & David Kelley, Crown Business, 2013, ISBN 978-0385349369.

THEORY OF MACHINES LABORATORY

VI Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME111	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 36**				**Total Classes: 36**		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic principles of kinematics and the related terminology of machines.
II. Discriminate mobility; enumerate links and joints in the mechanisms.
III. Formulate the concept of analysis of different mechanisms.

LIST OF EXPERIMENTS

Week-1	**GOVERNORS**
To study the function of a Governor.	
Week-2	**GYROSCOPE**
To determine the Gyroscope couple.	
Week-3	**STATIC FORCE ANALYSIS**
To draw free body diagram and determine forces under static condition.	
Week-4	**DYNAMIC FORCE ANALYSIS**
To draw free body diagram and determine forces under dynamic condition.	
Dynamic force analysis.	
Week-5	**BALANCING**
To determine balancing forces and reciprocating masses.	
Week-6	**BEARINGS**
To determine the bearing life.	
Week-7	**VIBRATIONS**
To determine the longitudinal and transfer vibration.	
Week-8	**WHIRLING**
To determine critical speed of a shaft.	
Week-9	**MECHANISMS**
To design various mechanism and their inversions.	

Week-10	DIFFERENTIAL GEAR BOX
To study automobile differential gear box.	
Week-11	**INDEXING**
To study various intermittent mechanism.	
Week-12	**EXAMINATIONS**
Text Books:	
1. Joseph E. Shigley, "Theory of Machines and Mechanisms", Oxford University Press, 4th Edition, 2010. 2. Thomas Bevan, "Theory of Machines", Pearson, 3rd Edition, 2009.	
Web References:	
1. http://www.iare.ac.in.	
Course Home Page:	

LIST OF EQUIPMENTS REQUIRED FOR BATCH OF 36 STUDENTS:

S. No	Equipment Name	Quantity
1	Gyroscope	1
2	Governors	1
3	Differential gear box	1
4	Balancing test rig	1
5	Vibration analysis test rig	1
6.	Dividing head	1
7.	Demonstration of different models of mechanism	1

HEAT TRANSFER LABORATORY

<table>
<tr><td colspan="9">VI Semester: ME</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td rowspan="2">AME112</td><td rowspan="2">Core</td><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 32</td><td colspan="3">Total Classes: 32</td></tr>
</table>

OBJECTIVES:

The courses should enable the students to:

I. Apply the basic modes of heat transfer and determine constants for different geometrics.
II. Estimate the Performance of parallel and counter flow heat exchangers.
III. Determine Stefan Botlzman constant-Black body radiation.
IV. Demonstration of application of heat transfer devices-heat pipes.

LIST OF EXPERIMENTS

Week-1	**COMPOSITE SLAB APPARATUS-OVERALL HEAT TRANSFER COEFFICIENT**
Determination the overall heat transfer coefficient for a composite slab	
Week-2	**HEAT TRANSFER THROUGH LAGGED PIPE**
Determination of thermal conductivity of a lagged pipe.	
Week-3	**HEAT TRANSFER THROUGH CONCENTRIC SPHERE**
Determination of thermal conductivity of concentric sphere.	
Week-4	**THERMAL CONDUCTIVITY OF GIVEN METAL ROD**
Determination of thermal conductivity of given metal rod.	
Week-5	**HEAT TRANSFER IN PIN FIN APPARATUS**
Determination of the effectiveness and efficiency of pin fin.	
Week-6	**EXPERIMENT ON TRANSIENT HEAT CONDUCTION**
Determination of thermal conductivity in transient mode.	
Week-7	**HEAT TRANSFER IN FORCED CONVECTION APPARATUS**
Determination of convective heat transfer coefficient in forced convection.	
Week-8	**HEAT TRANSFER IN NATURAL CONVECTION APPARATUS**
Determination of convective heat transfer coefficient in natural convection.	
Week-9	**PARALLEL AN DCOUNTER FLOW HEAT EXCHANGERS**
Determination of the effectiveness both experimental and theoretical method	
Week-10	**EMISSIVITY APPARATUS**
Determination of emissivity of grey and blackbody.	

WeeK-11	STEFAN BOTLZMAN APPARATUS
Determination of Stefan Botlzman constant and compare its value.	
Week-12	CRITICAL HEAT FLUX APPARATUS
Evaluate the critical heat flux value by studying different zones of boiling.	
Week-13	STUDY OF HEATPIPE
Study of heat pipe.	
Week-14	FILM AND DROP WISE CONDENSATION APPARATUS
Determination of different methods of condensation.	
Week-15	EXAMINATIONS

Reference Books:

1. Yunus A. Cengel, "Heat Transfer a Practical Approach", 4th Edition, Tata McGraw-Hill Education, 4th Edition, 2012.
2. R. C. Sachdeva, "Fundamentals of Engineering, Heat and Mass Transfer", New Age Publication, 3rd Edition, 2012.

Web References:

1. https://en.wikipedia.org/wiki/Heat_Transfer
2. https://en.wikipedia.org/wiki/Heat and Mass Transfer

Course Home Page:

LIST OF EQUIPMENTS REQUIRED FOR BATCH OF 36 STUDENTS:

S.No	Equipment Name	Quantity
1.	Composite slab apparatus	1
2.	Heat transfer through lagged pipe	1
3.	Heat transfer through concentric sphere	1
4.	Thermal conductivity of given metal rod	1
5.	Heat transfer in Pin fin apparatus	1
6.	Experiment on transient heat conduction	1
7.	Heat transfer in forced convection apparatus	1
8.	Heat transfer in natural convection apparatus	1
9.	Parallel and counter flow heat exchangers	1
10.	Emissivity apparatus	1
11	Stefan Botlzman apparatus	1
12	Critical heat flux apparatus	1
13	Study of heat pipe	1
14	Film and drop wise condensation apparatus	1

LIST OF CONSUMABLES REQUIRED FOR A BATCH OF 36 STUDENTS:

S.No	Consumable Name	Quantity
1.	Uninterrupted power and water supply	As required

FLUID THERMAL MODELING AND SIMULATION LABORATORY

VI Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME113	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45			Total Classes: 45			

OBJECTIVES:

The courses should enable the students to:

I. Analyze the fluid flow through pipes.
II. Understand the external fluid flow.
III. Apply simulation techniques to heat flow problems.
IV. Evaluate the thermal stresses of real time problems.
V. Demonstrate the 3D Heat conduction for real time problems.

LIST OF EXPERIMENTS

Week-1	**INTERNAL PIPE FLUID FLOW – FEM**
Internal Pipe flow problem Using theoretical FEM.	
Week-2	**INTERNAL PIPE FLUID FLOW - ANSYS**
Analyzing Flow in a System of Pipes using ANSYS.	
Week-3	**INTERNAL PIPE FLUID FLOW – MATLAB**
Internal Pipe flow problem using MAT LAB.	
Week-4	**EXTERNAL FLUID FLOW**
Determination of the drag coefficient of a circular cylinder immersed in a uniform fluid stream using ANSYS/SolidWorks Flow Simulation.	
Week-5	**FLOW THROUGH BALL VALVE**
Flow of water through a ball valve assembly using ANSYS/ SolidWorks Flow Simulation.	
Week-6	**HEAT CONDUCTION**
Heat Conduction within a Solid using ANSYS.	
Week-7	**TEMPERATURE DISTRIBUTION**
Temperature distribution in a fin cooled electronic component using ANSYS.	
Week-8	**3D HEAT CONDUCTION**
3D Heat Conduction within a Solid-Cell Phone using ANSYS.	
Week-9	**COUNTER FLOW HEAT EXCHANGER**
Calculation of the efficiency of the counter flow heat exchanger using ANSYS/SolidWorks Flow Simulation.	

Week-10	CONJUGATE HEAT TRANSFER
Conjugate heat transfer problem using ANSYS/ Solid Works Flow Simulation.	
WeeK-11	3D THERMAL ANALYSIS
3D Thermal Analysis, Finned Pipe using ANSYS.	
Week-12	THERMAL STRESS ANALYSIS
Thermal stress analysis of piston.	
Week-13	REVIEW OF FLUID PROBLEMS
Week-14	REVIEW OF THERMAL PROBLEMS
Week-15	EXAMINATION
Text Books:	
1. Janna, W.S., "Design of Fluid Thermal Systems", Cengage Learning, 3rd Edition, 2011. 2. Jaluria, Y., "Design and Optimization of Thermal Systems", McGraw-Hill, 2nd Edition, 2007. 3. McDonald, A. G., and Magande, H. L., "Thermo-Fluids Systems Design", John Wiley, 1st Edition, 2012. 4. Suryanarayana, N. V. and Arici, Ö., "Design and Simulation of Thermal Systems", McGraw-Hill, 1st Edition, 2003.	
Web References:	
1.https://docs.google.com/document/d/1UaDrm0pnHgd8GnN7dAcXM6EikgqAD7BU 0d52VFZz1w/edit 2. http://www.iare.ac.in	
Course Home Page:	

LIST OF EQUIPMENTS REQUIRED FOR BATCH OF 36 STUDENTS :

S.No	Equipment Name	Quantity
1.	Auto CAD Software	30 licenses
2.	ANSYS Software	30 licenses
3.	MATLAB Software	30 licenses
4.	CATIA Software	30 licenses
5.	Solid Works Software	30 licenses
6.	Hyper Mesh Software	30 licenses
7.	Fluent Software	30 licenses
8.	Gambit Software	30 licenses

REFRIGERATION AND AIR CONDITIONING

VII Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME017	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand vapour compression, vapour absorption and air refrigeration systems.
II. Analyze the refrigeration cycles and methods for improving the performance using standard data hand book with p-h charts.
III. Familiarize the components of refrigeration systems.
IV. Identify various psychometric properties and processes.
V. Design air-conditioning systems using cooling load calculations.

UNIT-I	INTRODUCTION TO REFRIGERATION	Classes : 09

Basic concepts: unit of refrigeration and COP, refrigerators, heat pump, Carnot refrigerator, applications of refrigerators, air refrigeration: Bell-Coleman cycle, open and dense air system, ideal and actual refrigeration, applications, vapor compression refrigeration, ideal cycle, effect of sub cooling of liquid, super heating of vapor, deviations of practical (actual cycle) from ideal cycle, construction and use of p-h chart problems.

UNIT-II	VAPOUR ABSORPTION REFRIGERATION AND AIR REFRIGERATION	Classes: 09

Vapor absorption refrigeration: description, working of NH3-Water, Li Br–water system, calculation of HCOP, Principle and operation of three fluid vapor absorption refrigeration systems. steam jet refrigeration system, working principle, basic operation; Refrigerants: Properties, nomenclature selection of refrigerants, effects of refrigerants on global warming, alternate refrigerants.

UNIT-III	REFRIGERATOR COMPONENTS	Classes : 09

Compressors: classification, working, advantages and disadvantages; Condensers: classification, working Principles.

Evaporators: classification, working Principles; Expansion devices: types, working principles.

UNIT-IV	INTRODUCTION TO AIR CONDITIONING	Classes: 09

Psychometric properties and processes, sensible and latent heat loads, characterization, need for ventilation, consideration of Infiltration, load concepts of RSHF, ASHF, ESHF and ADP; concept of human comfort and effective temperature, comfort air conditioning, industrial air conditioning and requirements, air conditioning load calculations.

UNIT-V	AIR CONDITIONING SYSTEMS	Classes : 09

Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers, heat pump, heat sources, different heat pump circuits, applications.

Text Books:

1. Manohar Prasad, “Refrigeration and Air Conditioning” New Age International, 3rd Edition, 2015
2. S. C. Arora, Domkundwar, “A Course in Refrigeration and Air-conditioning”, Dhanpatrai Publications, Edition 2014.

Reference Books:

1. C. P. Arora, “Refrigeration and Air Conditioning” Tata McGraw-Hill, 17th Edition, 2006.
2. Ananthanarayanan, “Basic Refrigeration and Air Conditioning”, Tata McGraw-Hill, 2015.
3. R.K.Rajput “A text of Refrigeration and Air Conditioning” S. K. Kataria & Sons, 3rd Edition, 2009.
4. P. L. Ballaney, “Refrigeration and Air Conditioning” Khanna Publishers, 16th Edition, 2015.

Web References:

1. http://engineeringstudymaterial.net/tag/air-conditioning-and-refrigeration-books/
2. http://books.mcgraw-hill.com/engineering/PDFs/Miller.pdf
3. http://royalmechanicalbuzz.blogspot.in/2015/12/refrigeration-and-air-conditioning-by-cp-arora-pdf-ownload.html
4. https://en.wikipedia.org/wiki/Air_conditioning

E-Text Book:

1. http://www.mechanicalgeek.com/refrigeration-and-air-conditioning-by-rs-khurmi-pdf/
2. engineeringstudymaterial.net/tag/air-conditioning-and-refrigeration-books/

Course Home Page:

COMPUTER AIDED DESIGN/COMPUTER AIDED MANUFACTURING

VII Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME018	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the concept of implementation automation and PLMS in industries practicing CIM.
II. Recognize the need of computer graphics in seamless manufacturing environment.
III. Summarize the historical development of CAD/CAM software and CNC Technology.
IV. Categorize the creation of group technology of part families and end-end utility.

UNIT-I FUNDAMENTAL CONCEPTS IN CAD — Classes : 09

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices, raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT-II GEOMETRICAL MODELLING AND DRAFTING SYSTEMS — Classes : 09

Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, solid modeling, modeling facilities desired, Basic geometric commands, layers, display control commands, editing, dimensioning.

UNIT-III COMPUTER AIDED MANUFACTURING — Classes: 09

Numerical control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of machining center, turning center;

CNC part programming: fundamentals, manual part programming methods, computer aided part programming.

UNIT-IV GROUP TECHNOLOGY, CAPP AND CAQC — Classes: 09

Group technology: Part family, coding and classification, production flow analysis, advantages and limitations, computer Aided Processes Planning, Retrieval type and generative type, terminology in quality control, the computer in QC, contact inspection methods, non-contact inspection methods, optical, computer aided testing, integration of CAQC with CAD/CAM.

UNIT-V COMPUTER INTEGRATED MANUFACTURING SYSTEMS — Classes: 09

Types of manufacturing systems, machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

Text Books:

1. William M Neumann and Robert F.Sproull "Principles of Computer Graphics", McGraw-Hill Book Co. Singapore, 1st Edition, 1989.
2. Ibrahim Zeid, "Mastering CAD/CAM", McGraw-Hill, 1st Edition, 2007.
3. K. Lalit Narayan, K. Mallikarjuna Rao and M.M.M. Sarcar, Computer Aided Design Manufacturing, PHI, 1st Edition, 2008.

Reference Books:

1. Yoram Koren, "Computer Control of Manufacturing Systems", McGraw-Hill, 1st Edition, 1983.
2. Groover, M. P. and Zimmers, E. W., "CAD/CAM: Computer Aided Design & Manufacturing", Pearson Education India, 1st Edition, 2006.

Web References:

1.http:// nptel.ac.in/courses/112102101/
2.http:// nptel.ac.in/courses/112102103/
3.https://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-009/lecturenotes/

E-Text Book:

1. https:/elsevier.com/books/curves-and-surfaces-for-cagd/farin/978-1-55860-737-8
2. http:/springer.com/in/book/9789401171229

Course Home Page:

INSTRUCTMENTATION AND CONTROL SYSTEMS

Text Books:
1. D. S. Kumar, "Measurement Systems: Applications & Design", Anuradha Agencies, 1st Edition, 2013. 2. C. Nakra, K. K. Choudhary, "Instrumentation, Measurement & Analysis", Tata McGraw-Hill, 1st Edition, 2013.
Reference Books:
1. Chennakesava R Alavala, "Principles of Industrial Instrumentation and Control Systems", Cengage Learning, 1st Edition, 2013. 2. S. Bhaskar, "Instrumentation and Control systems", Anuradha Agencies, 1st Edition, 2013. 3. Holman, "Experimental Methods for Engineers", McGraw-Hill, 8th Edition, 2013 4. R. K. Jain, "Mechanical and Industrial Measurements", Khanna Publishers, 1st Edition, 2013. 5. Sirohi, Radhakrishna, "Mechanical Measurements", New Age, 3rd Edition, 2015. 6. A. K. Tayal, "Instrumentation & Mech. Measurements", Galgotia Publications, 1st Edition, 2013.
Web References:
1. http://nptel.ac.in/courses/112106138/
E-Text Book:
1. http://elearning.vtu.ac.in/newvtuelc/courses/10ME42B.html
Course Home Page:

COMPUTER AIDED MODELING AND ANALYSIS LABORATORY

VII Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME114	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45				Total Classes:45		

OBJECTIVES:

The course should enable the students to:

I. Understand code of drawing practice as per BIS conventions for mechanical elements using CAD software.
II. Prepare the 2-D and 3-D drawings using parametric solid software's as per industry templates.
III. Solve vector and scalar problems for structural and thermal fields using analysis software's.
IV. Summarize computer aided engineering results with real time problems.

LIST OF EXPERIMENTS

Week-1 INTRODUCTION TO CATIA

Familiarization and practicing of drawing and modifying commands, template creation, lettering, object snapping and sectioning.

Week-2 DRAFTING OF SIMPLE 2D DRAWINGS

Prepare the 2D drawings using draw and modify commands for simple geometric assemblies, sectional views for part drawing and assemblies.

Week-3 SOLID MODELING

Preparing the 2D and 3D models (wire frame, surface and solid models) by using B-REP, CSG. Introduction of Boolean operations. Generation of 2D, 3D models through protrusion, revolve, sweep.

Week-4 CREATING ORTHOGRAPHIC VIEWS FROM SOLID MODELS

Development of orthographic views for assembly drawings and preparation of bill of materials(IC engine components, Machine tool accessories, Jigs and Fixtures).

Week-5 INTRODUCTION TO ANSYS

Determination of deflection and stresses in bar.

Week-6 TRUSSES AND BEAMS

Determination of deflection and stresses in 2D and 3D trusses and beams.

Week-7 SHELL STRUCTURES

Determination of stresses in 3D and shell structures (one example in each case).

Week-8 HARMONIC ANALYSIS

Estimation of natural frequencies and mode shapes, harmonic responses of 2D beams.

Week-9	**HEAT TRANSFER ANALYSIS**
Steady state heat transfer analysis of plane and axi-symmetric components.	
Week-10	**CONVENTIONAL REPRESENTATION OF MATERIALS**
Conventional representation of parts screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits, methods of indicating notes on drawings.	
Week-11	**LIMITS, FITS AND TOLERANCES**
Limits, Fits and Tolerances: Types of fits, exercises involving selection, interpretation of fits and estimation of limits from tables.	
WeeK-12	**FORM AND POSITIONAL TOLERANCES**
Introduction and indication of form and position tolerances on drawings, types of run out, total run out and their indication.	
Week-13	**SURFACE ROUGHNESS AND ITS INDICATION**
Definition, types of surface roughness indication surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.	
Week-14	**DETAILED AND PART DRAWINGS**
Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors.	
Week-15	**PRODUCTION DRAWING PRACTICE**
Part drawings using computer aided drafting by CAD software.	
Reference Books:	
1. K.L. Narayana, P. Kannaiah, “Production Drawing”, New Age publishers, 3rd Edition, 2009. 2. Goutham Pohit, Goutham Ghosh, “Machine Drawing with Auto CAD”, Pearson, 1st Edition, 2004. 3. James D. Meadows, “Geometric Dimensioning and Tolerancing”, CRC Press, 1st Edition, 1995.	
Web Reference:	
1. https://mech.iitm.ac.in/Production%20Drawing.pdf	
Course Home Page:	

LIST OF EQUIPMENTS REQUIRED FOR BATCH OF 36 STUDENTS:

S.No	Equipment Name	Quantity
1	Drafting Software-AutoCAD	36
2	CAD Modeling Software	36
3	Analysis Software-ANSYS Workbench	36
4	Desktops systems	36

COMPUTER AIDED NUMERICAL CONTROL LABORATORY

VII Semester: ME

Course Code	Category	Hours /Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME115	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes:36				Total Classes:36		

OBJECTIVES:

The course should enable the students to:

I. Understand the features and specifications of CNC and 3D printing machines.
II. Develop the process planning sheets and tool layouts.
III. Use the CAM software and prepare CNC part programs.
IV. Execute the part program and machine the component as per the production drawing.

LIST OF EXPERIMENTS

WEEK-1 INTRODUCTION TO COMPUTER NUMERICAL CONTROL

Numerical control, functions of a machine tool, concept of numerical control, historical development, definition, advantages of CNC machine tools.

WEEK-2 INTRODUCTION TO COMPUTER NUMERICAL CONTROL

Evolution of CNC, advantages of CNC, limitations of CNC, features of CNC, machine control unit (MCU) for CNC, classification of CNC machine tools; CNC machining centers: classification, features of CNC machining centers.

WEEK-3 CNC MILLING

Basic fundamentals of CNC milling, familiarization of machine control panel.

WEEK-4 CNC MILLING

Fundamentals of CNC programming, Part programming and interpolation techniques.

WEEK-5 CNC MILLING

Machining practice on CNC milling.

WEEK-6 CAM SOFTWARE

Generation of part programming through CAM software package.

WEEK-7 CAM SOFTWARE

CAM-CNC programming and execution.

WEEK-8 CNC TURNING

Work piece setting methods, tool setting methods.

WEEK-9	CNC TURNING
Practice on CNC turning and exercises on machine.	
WEEK-10	**CAM SOFTWARE**
Generation of part programming through the CAM software package, CAM-CNC programming and execution on milling and turning machines.	
WEEK-11	**3D PRINTING**
Prepare simple prototype models.	
WEEK-12	**INDUSTRY-INSTITUTE INTERACTION**
Practice session at industry	

Reference Books:

1. Kundra T. K., Rao P. N. and Tewari M. K., “Numerical Control and Computer Aided Manufacturing”, Tata McGraw-Hill, 1st Edition, 1990.
2. Groover M.P., “Automation, Production Systems & Computer Integrated Manufacturing.”, Prentice Hall, 1st Edition, 1989.
3. Elanchezhian C, Selwyn Sunder T, Shanmuga Sundar G., “Computer Aided Manufacturing”, Laxmi Publications, New Delhi, 1st Edition, 2006.
4. Rao P N., “CAD/CAM Principles and Applications”, Tata McGraw-Hill, 1st Edition, 2006.

Reference Books:

1. FANUC and SIEMENS part programming manuals
2. 3D printing manual – ULTIMAKE

Web References:

1. http://www.mheducation.co.in/9780070634343-india-mastering-cadcam-sie
2. http://www.mheducation.co.in/9780070681934-india-cadcam-principles-and-applications
3. www.engr.uvic.ca/.../CNC_Computer_Numerical_Control_Programmig_Basics.pdf

Course Home Page:

LIST OF EQUIPMENTS REQUIRED FOR BATCH OF 36 STUDENTS:

S.No	Equipment Name	Quantity
1	CNC Turing Center with Seimens Operating system	1
2	CNC Vertical Drill tap center with FANUC-i Operation System	1
3	CAM Software-CADEM (CAPSTURN and CAPSMILL)	5
4	3D Printing machine	1

LIST OF CONSUMABLES REQUIRED FOR A BATCH OF 36 STUDENTS:

S.No	Consumable Name	Quantity
1	Standard cutting tools	As required
2	BT-30 Standard tool holders	As required
3	Teflon rod (25 dia.)	2m
4	Al plate (300x 300 x 10mm thick)	2 No
5	MS Flat (50mm x 25 mm thick)	2m
6	Lubrication oil	10lts
7	Grease	1kg
8	Servocut –S coolant oil	30lts
9	Cotton Waste	30kg
10	Poly lactic acid	1 unit
11	Acrylonitrile Butadiene Styrene	1unit
12	Standard Metrology inspection equipment	As required

INSTRUMENTATION AND CONTROL SYSTEMS LABORATORY

<table>
<tr><td colspan="9">VII Semester: ME</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AME116</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes:33</td><td colspan="3">Total Classes:33</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Configure and calibrate for physical quantities like pressure, temperature, speed, displacement.
II. Experiment for condition monitoring of machine tools and IC engines by using seismic pickup (vibrometer).
III. Study the deflection by using strain gauge on cantilever beam.
IV. Draw the characteristic calibration curves.

LIST OF EXPERIMENTS

Week-1	**CALIBRATION OF CAPACTIVE TRANSDUCER**
Calibration of capacitive transducer for angular measurement.	
Week-2	**CALIBRATION OF LVDT**
Study and calibration of LVDT transducer for displacement measurement.	
Week-3	**STUDY OF RESISTANCE TEMPERATURE DETECTOR**
Study of resistance temperature detector for temperature measurement.	
Week-4	**CALIBRATION OF THERMISTOR**
Calibration of thermistor for temperature measurement.	
Week-5	**CALIBRATION OF THERMOCOUPLE**
Calibration of thermocouple for temperature measurement.	
Week-6	**CALIBRATION OF PRESSURE GUAGE**
Calibration of Pressure gauges.	
Week-7	**CALIBRATION OF STRAIN GUAGE**
Calibration of strain gauge for temperature measurement.	
Week-8	**CALIBRATION OF PHOTO AND MAGNETIC SPEED PICKUP**
Study and calibration of photo and magnetic speed pickups for the measurement of speed.	

Week-9	CALIBRATION OF ROTAMETER
Study and calibration of rotameter for flow measurement.	
WeeK-10	CALIBRATION OF VIBROMETER
Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.	
Week-11	MEASUREMENT OF VACUUM
Study and calibration of Mcleod gauge for low pressure.	
Reference Books:	
1. D. S. Kumar, "Measurement Systems: Applications & Design", Anuradha Agencies, 1st Edition, 2013. 2. C. Nakra, K. K. Choudhary, "Instrumentation, Measurement & Analysis", Tata McGraw-Hill, 1st Edition, 2013.	
Web References:	
1. www.iare.ac.in	
Course Home Page:	

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS:

S.No	Equipment Name	Quantity
1	Capactive transducer	1
2	LVDT	1
3	RTD unit	1
4	Thermocouple Unit	1
5	Dead weight unit	1
6	Strain gauge	1
7	Photo and magnetic pick up	1
8	Vibrometer	1
9	Rotometer	1
10	Mcleod Gauge	1
11	Thermister	1

AUTOMOBILE ENGINEERING

VIII Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME020	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the function of various parts of automobile, features of fuel supply systems for S.I and C.I engines.
II. Distinguish the features of various types of cooling, ignition and electrical systems.
III. Identify the merits and demerits of the various transmission and suspension systems.
IV. Recognize the working of various braking and steering systems.
V. Summarize the ways and means of reducing the emissions from automobiles.

UNIT-I	INTRODUCTION	Classes: 09

Introduction to automobile engineering, chassis and body components, types of automobile engines, engine lubrication, engine servicing; Fuel system; spark ignition engine fuel supply systems, mechanical and electrical fuel pump, filters, carburetor types, air filters, petrol injection, multipoint fuel injection(MPFI) and gasoline direct injection systems; Compression ignition engines fuel supply systems, requirement of diesel injection systems, types of injection systems, direct injection systems, indirect injection (IDI) systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps, CRDI and turbocharged direct injection (TDI) systems.

UNIT-II	COOLING SYSTEM	Classes: 09

cooling requirements, air cooling, water cooling, thermo, water and forced circulation system, radiators types cooling fan, water pump, thermostat, pressure sealed cooling, antifreeze solutions, intelligent cooling; Ignition system**:** Function of an ignition system, battery ignition system constructional features of storage, battery, contact breaker points, condenser and spark plug, magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers, spark advance and retard mechanism; Electrical system**:** Charging circuit, generator, current-voltage regulator, starting system, bendix drive mechanism solenoid switch, lighting systems, automatic high beam control, horn, wiper, fuel gauge, oil pressure gauge, engine temperature indicator.

UNIT-III	TRANSMISSION AND SUSPENSIONS SYSTEMS	Classes: 09

Transmission system: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid flywheel, gear box, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box, auto transmission, continuous variable transmission over drive, torque converter, propeller shaft, Hotch-Kiss drive, torque tube drive, universal joint, differential, rear axles, types, wheels and tyres.

Suspension system: Objects of suspension systems, rigid axle suspension system, torsion bar, shock absorber, independent suspension system, air suspension system, Daimler-benz vehicle suspension.

UNIT-IV	BRAKING AND STEERING SYSTEMS	Classes: 09

Braking system: Mechanical brake system, Hydraulic brakes system, Master cylinder, wheel cylinder tandem master cylinder; Requirement of brake fluid, Pneumatic and vacuum brake, anti skid braking (ABS), regenerative braking; Steering system: Steering geometry, camber, castor, king pin, rake,

combined angle, toe-in, toe-out, center point steering, types of steering mechanism, power steering, Hydraulic, electronics, Ackerman steering mechanism, Davis steering mechanism, steering gears types, steering linkages, special steering colomuns.		
UNIT-V	**EMISSIONS FROM AUTOMOBILES**	**Classes: 09**
Emissions from Automobiles, Pollution standards national and international, various pollution control techniques: Multipoint fuel injection for spark ignition engines, common rail diesel injection, variable valve timing, closed crank cake ventilisation, p[c valus, EGR value, catalytic converters, catalyst window, lambda probe, energy alternatives, solar, photo-voltaic, hydrogen, biomass, alcohols, LPG, CNG, liquid Fuels and gaseous fuels, hydrogen as a fuel for internal combustion engines, their merits and demerits, standard vehicle maintenance practice.		
Text Books:		
1. Willam H Crouse, Donald L. Anglin, "Automobile Engineering", McGraw-Hill, 10th Edition, 2006. 2. Manzoor, Nawazish Mehdi, Yosuf Ali, "A Text Book Automobile Engineering", Frontline Publications, 1st Edition, 2008. 3. Dr. Kirpal Singh, "Automobile Engineering", Standard Publishers", 2nd Edition, 2013.		
Reference Books:		
1. R.K. Rajput, "A Text Book of Automobile Engineering", Laxmi Publications, 1st Edition, 2010. 2. S. Srinivasan, "Automotive Engines", McGraw-Hill, 2nd Edition, 2003. 3. Khalil U Siddiqui, "A Text Book of Automobile Engineering", New Age International, 1st Edition, 2009.		
Web References:		
1. http://nptel.kmeacollege.ac.in/syllabus/125106002/		
E-Text Books:		
1. http://www.engineeringstudymaterial.net/tag/automotive-engineering-books/ 2. www.engineering108.com/.../Automobile_Engineering/Automobile-engineering-ebook		
Course Home Page:		

OPERATIONS RESEARCH

VIII Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME021	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Formulate the mathematical model of real time problem for optimization.
II. Establish the problem formulation by using linear, dynamic programming, game theory and queuing models.
III. Apply stochastic models for discrete and continuous variables to control inventory.
IV. Visualize the computer based manufacturing simulation models.

UNIT-I	INTRODUCTION AND ALLOCATION	Classes : 09

Development, definition, characteristics and phases, types of operation research models, applications; Allocation**:** linear programming, problem formulation, graphical solution, simplex method, artificial variables techniques, two–phase method, big-M method.

UNIT-II	TRANSPORTATION AND ASSIGNMENT PROBLEM	Classes : 09

Transportation problem: Formulation, optimal solution, unbalanced transportation problem, degeneracy; Assignment problem, formulation, optimal solution, variants of assignment problem, traveling salesman problem.

UNIT-III	SEQUENCING AND REPLACEMENT	Classes: 09

Sequencing: Introduction, flow, shop sequencing, n jobs through two machines, n jobs through three machines, job shop sequencing, two jobs through 'm' machines.

Replacement: Introduction: Replacement of items that deteriorate with time, when money value is not counted and counted, replacement of items that fail completely, group replacement.

UNIT-IV	THEORY OF GAMES AND INVENTORY	Classes: 09

Theory Of Games: Introduction, minimax (maximin) criterion and optimal strategy, solution of games with saddle points, rectangular games without saddle points, dominance principle, mx2 and 2xn games, graphical method; Inventory**:** Introduction, single item, deterministic models, purchase inventory models with one price break and multiple price breaks, shortages are not allowed, stochastic models, demand may be discrete variable or continuous variable, instantaneous production, instantaneous demand and continuous demand and no set up cost, single period model.

UNIT-V	WAITING LINES AND SIMULATION	Classes : 09

Waiting Lines**:** Introduction, single channel, poisson arrivals , exponential service times, with infinite population and finite population models, multichannel, poisson arrivals, exponential service times with infinite population single channel Poisson arrivals**;** Simulation**:** Definition, types of simulation models, phases of simulation, applications of simulation, inventory and queuing problems, advantages and disadvantages, brief Introduction of simulation languages.

Text Books:
1. J. K. Sharma, "Operations Research", Macmillan, 5th Edition, 2012. 2. R. Pannerselvan, "Operations Research", 2nd Edition, PHI Publications, 2006.
Reference Books:
1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2013. 2. Maurice Saseini, Arhur Yaspan, Lawrence Friedman, "Operations Research: Methods & Problems", 1st Edition, 1959. 3. Hamdy A. Taha, "Introduction to O.R", PHI, 8th Edition, 2013. 4. Harvey M.Wagner, "Operations Research", PHI Publications, 2nd Edition, 1980.
Web References:
1. http://people.brunel.ac.uk/~mastjjb/jeb/or/contents.html 2. https://pe.gatech.edu/degrees/online-masters-degrees/operations-research 3. http://nptel.ac.in/courses/112106134/1
E-Text Book:
1. http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_qt.pdf 2 http://www.ggu.ac.in/download/Class-Note14/Operation%20Research07.04.14.pdf
Course Home Page:

HEATING VENTILATION AND AIR-CONDITIONING

<table>
<tr><td colspan="9">I Group: ME</td></tr>
<tr><th rowspan="2">Course Code</th><th rowspan="2">Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CIA</th><th>SEE</th><th>Total</th></tr>
<tr><td rowspan="2">AME501</td><td rowspan="2">Elective</td><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Analyze total energy consumed by HVAC equipment and establish a plan for better efficiency.
II. Inspect and measure insulation materials for R-value, evaluate heat and moisture content of air.
III. Demonstrate methods to control and ventilate a structure, describe various ways to clean the air in a structure.

UNIT-I	INTRODUCTION TO BASIC CONCEPTS	Classes : 09

Fundamentals: Modes of heat transfer, sensible heat and latent heat, basic components of air-conditioning and refrigeration machines, basic refrigeration system, vapour compression cycle, pressure, enthalpy chart, Classification of air-conditioning system, window A/C, working of window A/C with line diagrams, split A/C, types of split A/C, working of split A/C with line diagrams, ductable split A/C, working of ductable split A/C with line diagrams, variable refrigerant volume (VRV)/ variable refrigerant flow (VRF), ductable package A/C, working of ductable package A/C with line diagrams.

UNIT-II	PACKAGE ROOF TOP UNITS	Classes : 09

Package roof top units, central plant chill water system, categories of air conditioning, all air system, all water system, air-water system, direct refrigerant system, study of psychrometric charts, dry bulb temperature, wet bulb temperature, dew point temperature, relative humidity, humidity ratio, processes, heating, cooling, cooling and dehumidification, heating and humidification, finding values using the chart.

UNIT-III	LOAD CALCUALTIONS	Classes: 09

Load calculation, survey of building, cooling load steps, finding temperature difference (ΔT), wall glass roof partition, finding ‘U’ factor.

Wall glass roof partition, finding ventilation requirement for IAQ, load calculations (Manually using E-20 form), ESHF, ADP and air flow rate (CFM) calculation.

UNIT-IV	AIR DISTRIBUTION SYSTEM	Classes: 09

Air distribution system, duct-definition and terminology, duct design consideration, duct sizing methods, duct sizing as per aspect ratio, finding duct size using ductulator, calculation of number of sheets for duct gauge selection for sheet metal, bill of materials for duct network, legends and symbols used in the HVAC industry, selection of diffusers and grilles, duct materials and insulation materials used in HVAC Industry, study of overseas drawings, duct routing, preparation of single line diagram (SLD), preparation of layouts (double line diagram - DLD) as per SMACNA rules, openings for ducts passing through wall, sectional drawing at duct supports, concept of CAV and VAV .

UNIT-V	HYDRONIC SYSTEM AND FIRE PROTECTCION	Classes : 09

Static pressure calculation, selection of Motor HP, selection fan/blower RPM hydronic system, classification of water piping, pipe sizing for chill water system, fittings used in the HVAC piping system valves used in the HVAC piping system, function of valves, openings for CHW pipes passing through wall, sectional drawing at CHW Pipe supports pump head calculation, selection of Pump, air-conditioning concepts, fire protection (Awareness).

Text Books:

1. S. Don Swenson, "HVAC - Heating, Ventilating, and Air Conditioning", Amer Technical, 3rd Edition, 2003.
2. James E. Brumbaugh, "HVAC Fundamentals-Volumes 1-3", Audel, 4th Edition, 2004.

Reference Books:

1. S.C. Arora, Domkundwar, "A course in Refrigeration and Air Conditioning", Dhanpatrai Publications, 1st Edition 2014.
2. C.P. Arora, "Refrigeration and Air Conditioning" Tata McGraw-Hill, 17th Edition, 2006.
3. W. Larsen Angel, "HVAC Design Source Book", McGraw Hill Education, 1st Edition, 2011.
4. Stephen P. Kavanaugh, "HVAC Simplified", American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1st Edition, 2006.
5. Roger Haines, Michael Myers, "HVAC Systems Design Hand Book", McGraw-Hill Education, 5th Edition, 2009.

Web references:

1. https://www.youtube.com/channel/UC1jBZCSYJFo45cGmp1YyPFQ
2. https://www.youtube.com/channel/UCtbclVxT9QCXLC9VFLpKW4w
3. https://www.youtube.com/watch?v=zqXgmVnI3L8&list=PLE2DA184A2E479885
4. https://www.youtube.com/user/edisonhvac/playlists

E-Text Book:

1.https://www.uky.edu/bae/sites/www.uky.edu.bae/files/Chapter%207%20Heating%20Ventilation%20Air%20Conditioning.pdf
2. https://web.stanford.edu/class/cee243/Week1.pdf

Course Home Page:

GAS DYNAMICS

<table>
<tr><td colspan="9">I Group: ME</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">AME502</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Understand the basic concept of gas dynamics.
II. Analyze the behavior of Gas under various shock wave conditions.
III. Apply the knowledge for compressible flows in constant area with friction and heat transfer coefficient.
IV. Correlate fundamentals of gas dynamics with various mechanical systems.

UNIT-I	FUNDAMENTALS OF COMPRESSIBLE FLOW	Classes : 09

Ideal gas relationship, the adiabatic energy equation, Mach number and its significance, Mach waves, Mach cone and Mach angle, static and stagnation states, relationship between stagnation temperature, pressure, density and enthalpy in terms of Mach number, stagnation velocity of sound, reference speeds, various regions of flow, Effect of Mach number on compressibility, area velocity relationship.

UNIT-II	ONE DIMENSIONAL ISENTROPIC FLOW	Classes : 09

General features of isentropic flow, performance curve, comparison of adiabatic and isentropic process, One dimensional isentropic flow in ducts of varying cross-section, nozzles and diffusers, operation of nozzles under varying pressure ratio, mass flow rate in nozzles, critical properties and choking, area ratio as function of Mach number, impulse function, non-dimensional mass flow rate in terms of pressure ratio, area ratio and Mach number, working charts and gas tables, application of isentropic flow.

UNIT-III	NORMAL SHOCK WAVES	Classes: 09

Development of shock wave, thickness of shock wave, governing equations, strength of shock waves, Prandtl-Mayer relation, Rankine-Hugoniot relation, Mach number in the downstream of normal shock.

Variation of flow parameters across the normal shock, normal shock in Fanno and Rayleigh flows, impossibility of a rarefaction shock, supersonic diffusers, supersonic pitot tube.

UNIT-IV	FLOW IN CONSTANT AREA DUCT WITH FRICTION (FANNO FLOW)	Classes: 09

Fanno curve and Fanno flow equations, solution of Fanno flow equations, variation of flow properties, variation of Mach no. with duct length, isothermal flow in constant area duct with friction, tables and charts for Fanno flow, experimental friction coefficients.

UNIT-V	FLOW IN CONSTANT AREA DUCT WITH HEAT TRANSFER (RAYLEIGH FLOW)	Classes : 09

Simple heating relation of a perfect gas, Rayleigh curve and Rayleigh flow equations, variations of flow properties, maximum heat transfer, tables and charts for Rayleigh flow.

Text Books:

1. Anderson, J. D., “Modern Compressible flow”, McGraw-Hill, 3rd Edition, 2003.
2. S. M. Yahya, “Fundamentals of Compressible Flow”, New Age International (P) Limited, New Delhi, 1996.

Reference Books:

1. Liepmann, H.W, Roshko. A. “Elements of Gas Dynamics”, Dover Publications Inc., Mineola, NY, USA.
2. E. Rathakrishnan, “Gas Dynamics”, PHI Learning Pvt. Ltd, 1st Edition, 2010.
3. Oosthuizen,P.H., Carscallen, W.E., “Compressible Fluid Flow”, McGraw-Hill international editions, McGraw-Hill Companies, Inc., Singapore, 1st Edition, 2013.
4. Chapman A.J., Walker W.F. Introductory “Gas Dynamics”, Holt, Reinhart and Winston, Inc. NY, USA, 1st Edition, 2013.

Web References:

1. http://www3.nd.edu/~powers/ame.30332/notes.pdf
2. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-120-compressible-flow-spring-2003/
3. http://nptel.ac.in/courses/112106196/
4. http://nptel.ac.in/courses/112103021/

E-Text Book:

1. http://www.springer.com/gp/book/9789462391949
2. http://www.springer.com/series/1774
3. http://store.elsevier.com/One-Dimensional-Compressible-Flow/H_-Daneshyar/isbn-9781483146751/

Course Home Page:

COMPUTATIONAL FLUID DYNAMICS

I Group: ME									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME503	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand various computational techniques.
II. Solve Euler and Navier-Stokes equations using computational fluid dynamics.
III. Apply the computational fluid dynamics techniques and graphic skills to conduct the flow field calculations and data analysis.

UNIT-I FUNDAMENTAL CONCEPTS **Classes : 09**

Introduction, basic equations of fluid dynamics, incompressible in viscid flows: Source, vortex and doublet panel, methods, lifting flows over arbitrary bodies, mathematical properties of fluid dynamics equations, elliptic, parabolic and hyperbolic equations, well posed problems, discretization of partial differential equations, explicit finite difference methods of subsonic, supersonic and viscous flows.

UNIT-II GRID GENERATION **Classes : 09**

Structured grids, types and transformation, generation of structured grids, unstructured grids, delany triangulation.

UNIT-III DISCRETIZATION **Classes: 09**

Boundary layer equations and methods of solution, implicit time dependent methods for inviscid and viscous compressible flows, concept of numerical dissipation.

Stability properties of explicit and implicit methods, conservative upwind discretization for hyperbolic systems, further advantages of upwind differencing.

UNIT-IV FINITE ELEMENT TECHNIQUES **Classes: 09**

Overview of finite element techniques in computational fluid dynamics, strong and weak formulations of a boundary value problem.

UNIT-V FINITE VOLUME TECHNIQUES **Classes : 09**

Finite volume techniques, cell centered formulation, Lax-Vendoroff time stepping, Runge-Kutta time stepping, multistage time stepping, accuracy, cell vertex formulation, multistage time stepping, FDM, like finite volume techniques, central and up-wind type discretizations, treatment of derivatives, flux, splitting schemes, pressure correction solvers, SIMPLE, PESO, vorticity transport formulation, Implicit/semi-implicit schemes.

Text Books:

1. Pletcher, R. H., Tannehill, J. C., Anderson, D., "Computational Fluid Mechanics and Heat Transfer", 3rd Edition, CRC Press, 2011.
2. Ferziger, J. H., Peric, M., "Computational Methods for Fluid Dynamics", 3rd Edition, Springer, 2002.
3. Anderson, Jr.D., "Introduction to Computational Fluid Dynamics", McGraw-Hill, 2000.

Reference Books:

1. Ferziger, J. H., “Numerical Methods for Engineering Application”, 2nd Edition, Wiley, 1998.
2. Klaus A Hoffmann and Steve T. Chiang. “Computational Fluid Dynamics for Engineers”, Vols. I & II Engineering Education System, 1993.
3. Charles Hirsch, “Numerical Computation of Internal and External Flows”, Vols. I and II. John Wiley & Sons, New York, 1988.

Web References:

1. https://ocw.mit.edu/courses/mechanical-engineering/2-29-numerical-fluid-mechanics-spring-2015
2. http://nptel.ac.in/courses/112107080
3. http://nptel.ac.in/courses/112105045/
4. http://nptel.ac.in/courses/112104030/

E-Text Book:

1. https://www.elsevier.com/books/computational-fluid-dynamics/tu/978-0-08-098243-4
2. http://www.springer.com/gp/book/9783540850557

Course Home Page:

RENEWABLE ENERGY SOURCES

I Group: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME504	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Explore society's present needs and future energy demands.
II. Understand the need to conserve fossil fuels.
III. Apply different modes of renewable energy sources for optimization of energy production.
IV. Visualize the production of green energy.

UNIT-I	PRINCIPLES OF SOLAR RADIATION	Classes : 09

Role and potential of new and renewable source, the solar energy option, environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II	SOLAR ENERGY COLLECTION, STORAGE AND APPLICATIONS	Classes : 09

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Solar Energy Storage And Applications**:** Different methods, Sensible, latent heat and stratified storage, solar ponds; Solar applications: solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III	WIND ENERGY AND BIO-MASS	Classes: 09

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria; Bio-Mass**:** Principles of bio-Conversion.

Anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.engine operation and economic aspects.

UNIT-IV	GEO THERMAL ENERGY,OCEAN,TIDAL AND WAVE ENERGY	Classes: 09

Geothermal Energy**:** Resources, types of wells, methods of harnessing the energy, potential in India. Ocean Energy**:** OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles; Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V	DIRECT ENERGY CONVERSION	Classes : 09

Need for DEC, Carnot cycle, limitations, principles of DEC; Thermo-electric generators, seebeck, peltier and Joule-Thomson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects; Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

Text Books:

1. G. N. Tiwari, M. K. Ghosal, "Fundamentals of Renewable energy resources", Alpha Science, 1st Edition, 2013.
2. G. D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, 1st Edition, 2013.

Reference Books:

1. John Twidell, Tony Weir, “Renewable Energy Resources”, 2^{nd} Edition, 2013.
2. D. Yogi Goswami, Frank Kreith, Jan.F. Kreider, “Solar Power Engineering” CRC Press, 2^{nd} Edition, 2000.
3. K. M. Mittal, “Non-Conventional Energy Systems”, Wheeler, 1^{st} Edition, 2013.

Web References:

1. http://www.slideshare.net/mo7amedaboubakr/solar-collector-45031961
2. https://alison.com/courses/Renewable-Energy-Sources

E-Text Book:

1. http://www.cs.kumamoto-u.ac.jp/epslab/APSF/Lecture%20Notes/lecture-1.pdf
2. http://www.vssut.ac.in/lecture_notes/lecture1428910296.pdf

Course Home Page:

POWER PLANT ENGINEERING

I Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME505	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand the sources of energy for power generations.
II. Visualize the intricacies of establishing combustion engine power plants
III. Apply the knowledge of hydrology, non-conventional energy and nuclear power.
IV. Recognize the economics and environmental aspects.

UNIT-I	INTRODUCTION TO THE SOURCES OF ENERGY	Classes : 09

Introduction to the Sources of Energy: Resources and development of power in india; Steam power plant: Plant layout, Working of different circuits; Fuel and handling equipment, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems; Combustion process: Properties of coal overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and drought system, cyclone furnace, design and construction, dust collectors, cooling towers and heat rejection, corrosion and feed water treatment.

UNIT-II	INTERNAL COMBUSTION ENGINE PLANT, GAS TURBINE PLANT	Classes : 09

Internal combustion engine plant**:** Diesel power plant, introduction, internal combustion engines, types, construction, plant layout with auxiliaries, fuel supply system, air starting equipment, lubrication and cooling system, super charging**;** Gas turbine plant: Introduction, classification, construction, layout with auxiliaries, principles of working of closed and open cycle gas turbines, combined cycle power plants and comparison; Direct energy conversion: solar energy, fuel cells, thermo electric and thermo ionic, MHD generation.

UNIT-III	HYDRO ELECTRIC POWER PLANT, HYDRO PROJECT AND PLANT	Classes: 09

Hydro electric power plant: Water power, hydro logical cycle, flow measurement, drainage area characteristics, hydro graphs, storage and Poundage , classification of dams and spill ways;

Hydro Projects And Plant**:** Classification typical layouts, plant auxiliaries, plant operation pumped storage plants; Power from Non-Conventional Sources: Utilization of Solar-collectors; Principle of working, wind Energy, types, HAWT, VAWT tidal energy.

UNIT-IV	NUCLEAR POWER STATION	Classes: 09

Nuclear Power Station**:** Nuclear fuel, breeding and fertile materials, nuclear reactor, reactor operation, types of reactors, pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas cooled reactor, radiation hazards and shielding radioactive waste disposal.

UNIT-V	POWER PLANT ECONOMICS AND ENVIRONMENT CONSIDERATION	Classes : 09

Power plant economics and environmental considerations**:** Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, load curves, load duration curve, definitions of connected load, maximum demand, demand factor, average load, load factor, diversity factor, related exercises, effluents from power plants and Impact on environment, pollutants and pollution standards, methods of Pollution control.

Text Books:
1. Dr. P.C. Sharma, “A Text Book of Power Plant Engineering”, S.K.Kataria, 1st Edition, 2016. 2. I Arora, S. Domkundwar, “A Course in Power Plant Engineering:”, Dhanapat Rai, 1st Edition, 2014
Reference Books:
1. I Rajput, “A Text Book of Power Plant Engineering”, Laxmi Publications, 5th Edition, 2014. 2. P. K. Nag, “Power Plant Engineering”, Tata McGraw-Hill, 4th Edition, 2014. 3. G. D. Rai, “An Introduction to Power Plant Technology”, Khanna Publishers, 1st Edition, 2013. 4. C. Elanchezhian, L. Sravan Kumar, B. Vijay Ramnath, “Power plant Engineering, I. K. International Publishers, 1st Edition, 2013.
Web References:
1. http://www.slideshare.net/mo7amedaboubakr/solar-collector-45031961 2. https://alison.com/courses/Renewable-Energy-Sources
E-Text Book:
1. http://www.cs.kumamoto-u.ac.jp/epslab/APSF/Lecture%20Notes/lecture-1.pdf 2. http://www.vssut.ac.in/lecture_notes/lecture1428910296.pdf
Course Home Page:

JET PROPULSION AND ROCKETS

I Group: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME506	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the fundamentals of gas turbine theory and applications.
II. Ability to calculate the thermal efficiency thrust power and overall efficiency.
III. Visualize the geometry of inlets, combustors and nozzles in industrial applications.
IV. Analyze the axial flow compressor and turbines, velocity diagram and application in industrial field.

UNIT-I	FUNDAMENTALS OF GAS TURBINE THEORY	Classes : 09

Thermodynamic Cycles, open closed and semi-closed, parameters of performances, cycle modifications for improvement of performance; Jet Propulsion: Historical sketch-reaction principle, essential features of propulsion devices, thermal engines, classification of energy flow thrust, thrust power and propulsion efficiency, need for thermal jet engines and applications.

UNIT-II	TURBOPROPULSION AND TURBOJET	Classes : 09

Thermo dynamic cycles, plant layout, essential components, principles of operation, performance evaluation, thrust augmentation and thrust reversal, contrasting with piston engine propeller plant, power and efficiency calculations, turbojet, turbofan, and turboprop engines, ramjet engine, pulse-jet engine, turbo-jet engine, turboprop engine, thrust equation, ram efficiency, thermal efficiency of turbo-jet engine, propulsion efficiency, overall efficiency of a propulsive system.

UNIT-III	INLETS, COMBUSTORS, AND NOZZLES	Classes: 09

Introduction, subsonic inlets, supersonic inlets, gas turbine combustors, afterburners and ramjet.

Combustors, supersonic combustion, exhaust nozzle, numerical problems.

UNIT-IV	AXIAL FLOW COMPRESSOR	Classes: 09

Euler's turbo-machinery equations, axial flow compressor analysis, cascade action, flow field, velocity diagrams, flow annulus area stage parameters, degree of reaction, cascade airfoil nomenclature and loss coefficient, diffusion factor, stage loading and flow coefficient, stage pressure ratio, Blade Mach no., repeating-stage, repeating-row, meanline design, flow path dimensions, number of blades per stage, radial variation, design process, performance.

UNIT-V	AXIAL FLOW TURBINE	Classes : 09

Axial flow turbine : Introduction to turbine analysis, mean-radius stage calculations, stage parameters, stage loading and flow coefficients, degree of reaction, stage temperature ratio and pressure ratio, blade spacing, radial variation, velocity ratio, axial flow turbine stage flow path dimension, stage analysis, multistage design steps of design, single stage and two-stage, turbine performance, blade cooling.

Text Books:

1. Bertin, J.J, “Aerodynamics for Engineers”, Pearson Education, 4th Edition, 2012.
2. Anderson, Jr, “Fundamentals of Aerodynamics”, J.D., McGraw-Hill, 3rd Edition, 2013.

3. Kuethe, A.M, Chow, C., “Foundations of Aerodynamics”, Wiley, 5th Edition, 2013. 4. Karamcheti, Krishnamurthy, “Ideal fluid Aerodynamics”, Kreiger Publications, 2nd Edition, 2013.
Reference Books:
1. Kuchemann, D., “The Aerodynamic Design of Aircraft”, Pergamon Press, 1st Edition, 2013. 2. Shevell, R.S., “Fundamentals of Flight”, Pearson Education, 2nd Edition, 2013. 3. McCormick, B.W., “Aerodynamics, Aeronautics & Flight Mechanics”, John Wiley, 2nd Edition, 2013.
Web References:
1. http://nptel.ac.in/courses/112105126/36. 2. http://nptel.ac.in/courses/112105127/pdf/LM-40.pdf.
E-Text Book:
https://books.google.co.in/books/about/Fundamentals_of_aerodynamics.html?id=N3ZTAAAAMAAJ&redir_esc=y.
Course Home Page:

UNCONVENTIONAL MACHINING PROCESSES

II Group: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME507	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the need and importance of non-traditional machining methods and process selection.
II. Gain the knowledge to remove material by thermal evaporation, mechanical energy process.
III. Apply the knowledge to remove material by chemical and electro chemical methods.
IV. Analyze various material removal applications by unconventional machining process.

UNIT-I | INTRODUCTION | Classes : 09

Need for non-traditional machining methods, classifications of modern machining processes, considerations in process selection, materials application, Ultrasonic machining: Elements of the process, mechanics of metal removal, process parameters, economic considerations, application and limitations, recent developments.

UNIT-II | ABRASIVE JET MACHINING | Classes : 09

Abrasive jet machining, water jet machining and abrasive water jet machining: basic principles, equipments process variables, mechanics of metal removal, MRR, applications and limitations; Electro chemical processes: Fundamentals of electro chemical machining, electro chemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, tool design, surface finish and accuracy, economic aspect of ECM, simple problem for estimation of metal removal rate.

UNIT-III | THERMAL METAL REMOVAL PROCESSES | Classes: 09

General principle and applications of Electric discharge machining, electric discharge grinding, electric discharge wire cutting processes, power circuits in EDM, mechanism of metal removal in EDM, process parameters.

Selection of tool electrodes and dielectric fluids, surface finish and accuracy, characteristics of spark eroded surface and machine tool selection, wire EDM principle and applications.

UNIT-IV | ELECTRON BEAM MACHINING | Classes: 09

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non thermal processes, general principle and applications of laser beam machining, thermal features, cutting speed and accuracy of cut.

UNIT-V | PLASMA MACHINING | Classes : 09

Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries; Chemical machining principle, maskants, etchants, applications.

Text Books:

1. V. K. Jain, “Advanced Machining Processes”, Allied Publishers, 1st Edition, 2013.
2. Pandey P. C., Shah H.S., “Modern Machining Processes”, Tata McGraw-Hill, 1st Edition, 2013.

Reference Books:
1. Bhattacherya A, "New Technology", The Institute for Engineers, 1st Edition, 1973. 2. C. Elanchezhian, B. Vijaya Ramnath, M. Vijayan, "Unconventional Machining processes", Anuradha Publication, 1st Edition, 2005. 3. M. K. Singh, "Unconventional Machining processes", New Age International Publishers, 1st Edition, 2010.
Web References:
1. http://nptel.ac.in/courses/112105126/36. 2. http://nptel.ac.in/courses/112105127/pdf/LM-40.pdf.
E-Text Book:
1. http://engineeringstudymaterial.net/ebook/advanced-machining-processes. 2. https://books.google.co.in/books/about/Advanced_Machining_Processes.html?id=duBqhj2OlfAC. 3. https://books.google.co.in/books/about/Modern_Machining_Processes.html?id=uC3rHzhogmMC.
Course Home Page:

COMPUTER NUMERICAL CONTROL TECHNOLOGY

II Group: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME508	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students:

I. Study various system devices hardware and software interpolations.
II. Know various tooling systems used in CNC Machines.
III. Understand both manual and Computer Aided Programming for generating various contours.
IV. Study about the DNC systems and Adaptive Control used for various machining process.

UNIT-I **INTRODUCTION TO OPERATING SYSTEM** **Classes : 09**

Features of NC Machines, fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, features of NC machine tools, design consideration of NC machine tool, methods of improving machine accuracy.

UNIT-II **TWO DEGREE FREEDOM SYSTEMS** **Classes : 09**

CNC Machines Elements: Machine structure, guide ways, feed drives, spindles, spindle bearings; System devices: Drives, feedback devices, counting devices, interpolators for manufacturing systems: DDA integrator, DDA hardware interpolators, CNC software interpolators.

UNIT-III **MEMORY MANAGEMENT AND VIRTUAL MEMORY** **Classes: 09**

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system.

Modular fixturing, quick change tooling system, automatic head changers.

UNIT-IV **FILE SYSTEM INTERFACE** **Classes: 09**

NC Part Programming: Manual programming-Basic concepts, Point-to-Point, contour programming, canned cycles, parametric programming, computer-Aided Programming: General information, APT programming examples APT programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors, introduction to CAD/CAM software, automatic tool Path generation.

UNIT-V **NUMERICAL METHODS** **Classes : 09**

Deadlocks system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection and recovery from deadlock; protection, system protection, goals of protection, principles of protection, domain of protection, access matrix, implementation of access matrix, access control, revocation of access rights, capability-based systems, language-based protection.

Text Books:

1. Yoram Koren, "Computer Control of Manufacturing Systems", Tata McGraw-Hill, 1st Edition, 2009.
2. Elanchezhian, Sunder Selvan, Shanmuga Sunder, "Computer Aided Manufacturing", University Science Press, 2nd Edition, 2013.

Reference Books:
1. Manfred Weck, “Machining Tools Hand Book”, 1st Edition, 1984. 2. HMT, “Mechatronics”, Tata McGraw-Hill, 1st Edition, 2013. 3. Jon Stenerson, Kelly Curron Pul, “Computer Numerical Control-Operations and Programming” 3rd Edition, 2016.
Web References:
1. http://nptel.ac.in/courses/112105211/ 2. https://onlinecourses.nptel.ac.in/noc16_me21
E-Text Books:
1. https://accessengineeringlibrary.com/browse/cnc-handbook 2. www.engr.uvic.ca/.../CNC_Computer_Numerical_Control_Programmig_Basics.pdf
Course Home Page:

TOOL DESIGN

II Group: ME									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME509	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Identify different properties of materials suitable for cutting/ forming tools.
II. Illustrate principle of 3-2-1jigs and fixture to arrest the degree of freedom.
III. Design of bushing and special clamping methods for drill jigs.
IV. Gain knowledge in design and development of forming dies and punches for different materials.

UNIT-I	TOOL MATERIAL	Classes : 09

Tool materials: Properties of materials: Tools steels, Cast Iron, Mild or low carbon steels, Non metallic and nonferrous materials, Heat treating.

UNIT-II	DESIGN OF CUTTING TOOLS	Classes : 09

Design of cutting tools: Point cutting tools: Milling cutters, drills, selection of carbide steels, determination of shank size for single point carbide tools, determining the insert thickness for carbide tools.

UNIT-III	DESIGN OF JIGS AND FIXTURES	Classes: 09

Design of jigs and fixtures: Basic principles of location and clamping; Locating methods and devices, jigs, definition types.

General considerations in the design of drill jigs, drill bushing, methods of construction; Fixtures, vice fixtures, milling, boring lathe grinding fixtures.

UNIT-IV	DESIGN FOR SHEET METAL FORMING - I	Classes: 09

Design of sheet metal blanking and piercing dies: Fundamentals of die cutting operation, power press types, general press information, materials handling equipment, cutting action in punch and die operations, die clearance, types of die construction, die design fundamentals, banking and piercing die construction, pilots, stripper and pressure pads presswork material, strip layout, short run tooling for piercing.

UNIT-V	DESIGN FOR SHEET METAL FORMING – II	Classes : 09

Design of sheet metal bending, forming and drawing dies: Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing, determination of blank size, drawing force, single and double action draw dies.

Text Books:

1. Donaldson, "Tool Design", Tata McGraw-Hill, 1st Edition, 2013.
2. HMT, "Production Technology", Tata McGraw-Hill, 1st Edition, 2012.
3. R.K. Jain, S. C. Gupta, "Production Technology", Tata McGraw-Hill, 1st Edition, 2013.

Reference Books:
1. George F Dieter, “Mechanical Metallurgy”, Tata McGraw-Hill, 1st Edition, 2015. 2. C. Elanchezhian, M.Vijayan, “Machine Tools”, Anuradha Publications, 1st Edition, 2010.
Web References:
1. http://nptel.ac.in/courses/112106138
E-Text Book:
1. https://books.google.co.in/books/about/Tool_Design.html?id=-M_mtiYyB_EC
Course Home Page:

ADDITIVE MANUFACTURING TECHNIQUES

II Group: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME510	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Identify suitable time compression techniques for rapid product development.
II. Interpret the concept, process details with respect to different processes.
III. Describe the significance of each process parameter of various prototyping systems.
IV. Interpret the advantages, limitations and applications of various prototyping Systems.
V. Identify the various tooling required for rapid prototyping systems and reverse engineering& augmented reality.

UNIT-I	INTRODUCTION TO RAPID PRORTOTYPING	Classes : 09
Introduction: Prototype Fundamentals, Types and Roles of Prototype, Fundamentals of Rapid Prototyping, Phases of Development Leading to Rapid Prototyping, Advantages of Rapid Prototyping and Classifications of Rapid Prototyping System, Generic RP process. Rapid Product Development: An Overview virtual prototyping and testing technology, Physical Prototyping and Rapid Manufacturing technologies and Synergic, Integration Technologies.		
UNIT-II	LIQUID-BASED RAPID PROTOTYPING SYSTEMS	Classes : 09
Liquid-Based Rapid Prototyping Systems: Principle, Process parameter, Process details, Advantages, Disadvantages and Applications of Stereolithography Apparatus (SLA), Solid Ground Curing (SGC), Solid Object Ultraviolet-Laser Printer (SOUP), Rapid Freeze Prototyping and Microfabrication		
UNIT-III	SOLID-BASED RAPID PROTOTYPING SYSTEMS	Classes: 09
Solid-Based Rapid Prototyping Systems: Principle, Process parameter, Process details, Advantages, Disadvantages and Applications of Laminated Object Manufacturing (LOM); Fused Deposition Modeling (FDM), Paper Lamination Technology (PLT), Multi-Jet Modeling System (MJM) and CAM-LEM.		
UNIT-IV	POWDER-BASED RAPID PROTOTYPING SYSTEMS	Classes: 09
Powder-Based Rapid Prototyping Systems: Principle, Process parameter, Process details, Advantages, Disadvantages and Applications of Selective Laser Sintering (SLS), Laser Engineered Net Shaping (LENS), Multiphase Jet Solidification (MJS), Electron Beam Melting (EBM) and Three-Dimensional Printing (3DP) – Hands on Session.		
UNIT-V	RAPID TOOLING	Classes : 09
Rapid Tooling: Introduction to rapid tooling (RT), Indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, and 3D Keltool process, Direct rapid tooling methods: DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.		

Text Books:

1. Chua C K, Leong K F, Chu S L, “Rapid Prototyping: Principles and Applications in Manufacturing”, World Scientific, 3rd Edition, 2008.
2. Liou W L, Liou F W, “Rapid Prototyping and Engineering applications: A Tool Box for Prototype Development”, CRC Press, 1st Edition, 2007.

Reference Books:

1. Gibson D W Rosen, Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 1st Edition, 2014.
2. Kamrani A K, Nasr E A, “Rapid Prototyping: Theory and practice”, Springer, 1st Edition, 2006.
3. Rafiq I. Noorani, “Rapid Prototyping: Principles and Applications”, John Wiley & Sons, 1st Edition, 2005.

Web References:

1.https://nptel.ac.in/courses/112102103/16
2.https://nptel.ac.in/courses/112107078/37

E-Text Book:

1.https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf

Course Home Page:

DESIGN FABRICATION OF COMPOSITES

II Group : ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME511	Elective	L	T	P	C	CIA	SEE	Total
		3	1	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the role of matrix, fiber and filler in the design of polymer/metal matrix composites.
II. Elucidate linear elastic properties by rule of mixture, fabrication of composites, mechanical and tribological properties, and fracture behavior of composite materials.
III. Assortment of suitable Fabrication method for different Composite Materials
IV. Categorize alternatives involved in the design of composites.

UNIT-I INTRODUCTION TO COMPOSITE MATERIALS — Classes : 09

Introduction to composite materials: Definition, classification, types of matrices material and reinforcements, characteristics and selection, fiber composites, laminated composites, particulate composite, pre-pegs, and sandwich construction.

UNIT-II MICRO MECHANICAL ANALYSIS OF LAMINA AND BIAXIAL STRENGTH THEORIES — Classes : 09

Micro mechanical analysis of a lamina: Introduction, Evaluation of the four elastic moduli, rule of mixture, numerical problems; Biaxial strength theories: Maximum stress theory, maximum strain theory, Tsa Hill theory, Tsai, Wutensor theory, numerical problems.

UNIT-III MACRO MECHANICAL ANALYSIS OF LAMINA AND LAMINATE — Classes: 09

Macro mechanics of a lamina: Hooke's law for different types of materials, Number of elastic constants, derivation of nine independent constants for orthotropic material, two dimensional relationships of compliance and stiffness matrix. Hooke's law for two-dimensional angle lamina, engineering constants, numerical problems, Invariant properties, stress strain relations for lamina of arbitrary orientation, numerical problems.

Macro mechanical analysis of laminate: Introduction, code, Kirchoff hypothesis, CLT, A, B, and D matrices (Detailed derivation) engineering constants, special cases of laminates, numerical problems.

UNIT-IV MANUFACTURING PROCESS OF COMPOSITES — Classes: 09

Manufacturing: Layup and curing open and closed mould processing, hand layup techniques, bag moulding and filament winding, putrusion, pulforming, thermoforming, Injection moulding, cutting, machining and joining, tooling, quality assurance, introduction, material qualification, types of defects, NDT methods.

UNIT-V METAL MATRIX COMPOSITES AND ITS APPLICATION DEVELOPMENTS — Classes : 09

Metal Matrix Composites: Reinforcement materials, types, fabrication, characteristics and selection, base metals selection, applications; Application developments: aircrafts, missiles, space hardware, automobile, electrical and electronics, marine, recreational and sports equipment, future potential of composites.

Text Books:

1. Autar K. Kaw, "Mechanics of composite materials", CRC Press,2nd Edition, 2005.
2. Mein Schwartz, "Composite Materials Handbook", McGraw-Hill, 2nd Edition, 2013.

Reference Books:

1. Rober M. Joness, "Mechanics of Composite Materials", CRC Press, 2nd Edition, 2013.
2. MichaelW, Hye "Stress Analysis of Fiber Reinforced Composite Materials", DESTech Publications, 2013.

Web References:

1. http://manufacturing.stanford.edu/processes/Composites.pdf
2. http://nptel.ac.in/courses/112104168/

E-Text Books:

1. https://www.elsevier.com/books/analysis-of-composite-structures/decolon/978-1-903996-02-7
2. https://www.elsevier.com/books/fatigue-of-composite-materials/reifsnider/978-0-444-70507-5
3. https://www.elsevier.com/books/mechanics-of-composite-materials/aboudi/978-0-444-88452-7
4. https://www.elsevier.com/books/book-series/composite-materials-series

Course Home Page

PRECISION ENGINEERING

II Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME512	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand the BIS code fits and tolerances for geometrical dimensioning and tolerance (GD & T).
II. Understand the principal application of different measuring instruments.
III. Summarize the application of latest manufacturing techniques (nano).

UNIT-I	ACCURACY AND ALIGNMENT TESTS	Classes : 09

Accuracy and alignment tests: General concept of accuracy, Spindle rotation accuracy, test methods, displacement accuracy, dimensional wear of cutting tools, accuracy of NC systems, clamping errors, setting errors, location of rectangular prism, cylinder, basic type of tests, measuring instruments used for testing machine tools, alignment tests, straightness, flatness, parallelism, squareness, Circularity, cylindricity.

UNIT-II	INFLUENCE OF STATIC STIFFNESS,THERMAL EFFECTS	Classes : 09

Influence of static stiffness, thermal effects: Static stiffness, nature of deformation in a machine tool, overall stiffness of a lathe, compliance of work piece, errors due to the variation of the cutting force and total compliance, accuracies due to thermal effects, methods of decreasing thermal effects-Influence of vibration on accuracy.

UNIT-III	PRECISION MACHINING	Classes: 09

Top down and bottom up approach, development of Nanotechnology, precision and micro-machining, diamond turning of parts to nanometer accuracy.

Stereo microlithography, machining of micro-sized components, mirror grinding of ceramics, ultra precision block gauges.

UNIT-IV	NANO MEASURING SYSTEMS	Classes: 09

In-process measurement of position of processing point, post process and online measurement of dimensional features, mechanical measuring systems, optical measuring systems, electron beam measuring systems, pattern recognition and inspection systems.

UNIT-V	LITHOGRAPHY	Classes : 09

Nano Lithography: Photolithography, nano lithography, photolithography, electron beam lithography, ion Beam lithography, optical lithography, LIGA process, dip pen lithography, deep UV.

Text Books:

1. Murthy.R.L, "Precision Engineering in Manufacturing", New Age International, New Delhi, 2005.
2. Norio Taniguchi, "Nanotechnology", Oxford university press, Cambridge, 1996.

Reference Books:
1. Lee Tong Hong, "Precision Motion control, Design and Implementation", Springer Verlag, U.K., 2001. 2. Liangchi Zhang, "Precision Machining of Advanced Materials", Trans Tech Publications Ltd., Switzerland, 1st Edition, 2001. 3. Hiromu Nakazawa, "Principles of Precision Engineering", Oxford university press, 1st Edition, 1994.
Web References:
1. http://nptel.ac.in/courses/112106138/
E-Text Book:
1. https://accessengineeringlibrary.com/browse/precision-engineering
Course Home Page:

PLANT LAYOUT AND MATERIAL HANDLING

III Group: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME513	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Plan, Analyze and design to improve manufacturing and service facilities.
II. Apply techniques to evaluate and design material handling and storage systems.
III. Visualize plant layout and material handling in industries.

UNIT-I	INTRODUCTION TO PLANT LAYOUT	Classes : 09

Introduction, classification of layout, advantages and limitations of different layouts, layout design procedures, overview of the plant layout, process layout and product layout: Selection, specification, implementation and follow up, comparison of product and process layout.

UNIT-II	HEURISTICS FOR PLANT LAYOUT	Classes : 09

Heuristics for plant layout ALDEP, CORELAP, CRAFT, group layout, fixed position layout, Quadratic assignment model, branch and bound method.

UNIT-III	MATERIAL HANDLING SYSTEMS	Classes: 09

Introduction, material handling systems, material handling principles.

Classification of material handling equipment, relationship of material handling to plant layout.

UNIT-IV	BASIC MATERIAL HANDLING SYSTEMS	Classes: 09

Basic material handling systems: Selection, material handling method, path equipment, function oriented systems.

UNIT-V	METHODS TO MINIMIZE COST OF MATERIAL HANDLING	Classes : 09

Methods to minimize cost of material handling, maintenance of material handling equipments, safety in handling ergonomics of material handling equipment, design, miscellaneous equipments.

Text Books:

1. P. B. Mahapatra, “Operations Management”, PHI, 1st Edition, 2010.
2. Dr. KC Arora, Shinde, “Aspects of Material handling”, Lakshmi Publications, 1st Edition, 2013.

Reference Books:

1. R. L. Francis, LF Mc Linnis Jr, White, “Facility Layout & Location an analytical approach” , PHI, 1st Edition, 2013.
2. R. Paneersevlam, “Production and Operations Management”, PHI, 3rd Edition, 2012.

Web References:

1. http://nptel.ac.in/courses/112106138/

E-Text Book:

1. https://accessengineeringlibrary.com/browse/precision-engineering

Course Home Page:

MANAGEMENT INFORMATION SYSTEMS

III Group: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME514	Elective	3	-	-	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the concept of development of management information systems and interfacing.
II. Apply the techniques of database management systems for various organizations.
III. Implementation of management information system for maintenance and understand principles of system audit.

UNIT-I INTRODUCTION TO MANAGEMENT AND INFORMATION SYSTEM — Classes: 09

Introduction to management information system: Importance of information for management decision, systems approach and information, system development, information system, architecture, quantitative techniques and management information systems interfacing

UNIT-II STRUCTURE OF MANAGEMENT INFORMATION SYSTEM — Classes: 09

Structure of MIS: Basic structural concepts: formal and informal information, systems; public and private information systems; Information systems, MIS, office automation, decision support system, expert system, knowledge work, systems, artificial intelligence, group decision supports systems (GDSS).

UNIT-III MANAGEMENT DEVELOPMENT AND SYSTEM METHODOLOGY — Classes: 09

MIS development and system methodology: System development methodologies; SDLC approach, system analysis; Design; Concepts of database and database design.

System methodology, objectives, time and logic, knowledge and human dimension, system modeling for management information system.

UNIT-IV IMPLEMENTAION, EVALUATION MAINTAIANANCE AND CONTROL OF MIS — Classes: 09

Implementation, evaluation, maintenance and control of MIS: Software life cycle models verification and validation, testing security, coding techniques, detection of error, validation, cost benefit analysis, assessing the value and risk of information systems.

UNIT-V SYSTEM AUDIT — Classes: 09

System Audit: Pitfalls in MIS development. System engineering methodology for MIS problem solving, software engineering qualities, design, production, service, software specification, software metrics, software quality assurance.

Text Books:

1. C. Laudan, Jane P. Laudan, “Management Information systems”, Pearson, 3rd Edition, 2013.
2. Hossein, “Management Information system”, Cengage Learning, 5th Edition, 2013.

Reference Books:

1. W. S. Jawadeker, “Management Information Systems Text & Cases”, Tata McGraw-Hill, 4th Edition, 2011.

2. Rainer, Turaban, Potter, Introduction to Information systems", Wiley, 3rd Edition, 2013.
Web References:
1.www.cengage.com/mis/book_content/.../9780324830064_PPT_ch01_CE.ppt2. 2. http://www. nptel.ac.in/courses/122105022/
E-Text Books:
1. https://docs.google.com/document/d/1M8P-t.../ 2. https://books.google.co.in/.../Management_Information_Systems_Texts_And.html
Course Home Page:

NANOMATERIALS

III Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME515	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Recognize the importance of nano structures and technology.
II. Understand various characterization techniques and synthesis processes.
III. Identify various multi disciplinary industrial applications.

UNIT-I	INTRODUCTION TO NANOTECHNOLOGY	Classes : 09

Introduction: History and scope, can small things make a big difference, classifications of nano-structured materials, fascinating nanostructures, applications of nanomaterials, nature: The best nanotechnologist, challenges and future prospects.

UNIT-II	UNIQUE PROPERTIES OF NANOMATERIALS	Classes : 09

Unique properties of nanomaterials: Microstructure and defects in nanocrystalline materials: dislocations, twins stacklling faults and voids, grain boundries, triple and disclinations; Effects of nano-dimension on material behavior: Elastic properties, melting point, diffusivity, grain growth characteristics, enhanced solid solubility; Magnetic properties: Soft magnetic nanocrystalline alloy, permanent magnetic nanocrystalline material, giant magnetic resonance, electrical properties, optical properties, thermal properties and mechanical properties.

UNIT-III	SYNTHESIS ROUTES	Classes: 09

Synthesis Routes: Bottom up approaches: Physical vapor deposition, inert gas condensation, laser ablation, chemical vapor deposition, molecular beam epitaxy, sol-gel method, self assembly.

Top down approaches: Mechanical alloying, nano-lithography; Condensation of nanopowders: Shock wave consolidation, hot isostatic pressing and cold isostatic, spark plasma sintering.

UNIT-IV	TOOLS TO CHARACTERIZE NANOMATERIALS	Classes: 09

Tools to characterize nanomaterials: X-ray diffraction, small angle X-ray scattering(SAXS), scanning Electron microscopy(SEM), transmission electron microscopy(TEM), atomic force microscopy(AFM), scanning tunneling microscopy(STM), field ion microscopy (FEM), three dimensional atom probe(3DAP), nanoindentation.

UNIT-V	APPLICATION OF NANOMATERIALS	Classes : 09

Application of nanomaterials: Nano-electronics, micro and nano-electromechanical systems(MEMS/NEMS), nanosensors, nanocatalysts, food and agricultural industry, cosmetic and consumer goods, structure and engineering, automotive industry, water-treatment and the environment, nano-medical applications, textiles, paints, energy defence and space applications, concerns and challenges of nanotechnology.

Text Books:
1.B.S. Murthy P. Shankar, Baladev Raj, James Munday, " Text Book of Nano Science and Nano Technology", University Press-IIM, 1st Edition, 2013. 2. Charles P. Poole, Frank .J. Owens, "Introduction to Nanotechnology", Wiley, 1st Edition, 2012.
Reference Books:
1. T. Pradeep, "Nano: The Essential ", Tata McGraw Hill, 1st Edition, 2008. 2. Miachel F. Ashby, Paulo J. Ferreira, "Nano materials, Nanotechnologies and design", wiley, 1st Edition, 2013.
Web References:
1. http://nptel.ac.in/courses/112106138/
E-Text Book:
1. http://bookboon.com/en/nanotechnology
Course Home Page:

ENGINEERING OPTIMIZATION

III Group: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME516	Elective	L	T	P	C	CIA	SEE	Total
		3	1	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
II. Develop and promote research interest in applying optimization techniques in problems of Engineering and Technology.
III. Apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

UNIT-I	INTRODUCTION TO OPTIMIZATION	Classes : 09

Introduction: Optimal problem formulation, design variables, constraints, objective function, variable bounds; engineering optimization problems: Classification and Some examples (just theory and discussion): truss structure, ammonia structure, transit schedule and car suspension.

UNIT-II	SINGLE VARIABLE OPTIMIZATION	Classes : 09

Single variable non-linear optimization problems: Local minimum global minimum and inflection point, necessary and sufficient conditions theorems, some problems based on this; Numerical methods: Exhaustive search methods, Fibonacci method, golden section method and comparison, interpolation methods: quadratic.

UNIT-III	MULTI VARIABLE UNCONSTRAINED OPTIMIZATION	Classes: 09

Multivariable unconstrained non-linear optimization problems: Numerical methods direct search methods: Univariate method, Pattern Search methods: Powell, Hook-Jeeve's, Rosen Brock's search and Simplex methods, multivariable unconstrained non-linear optimization problems.

Gradient methods: Gradient of a function, importance, gradient direction search based methods: Steepest descent/ascent method, conjugate gradient method and variable meteric method.

UNIT-IV	MULTI VARIABLE CONSTRAINED OPTIMIZATION	Classes: 09

Multivariable constrained non-linear optimization problems classical optimization techniques: Constraints equations, Lagrangian method, inequalities-Kuhn-Tucker necessary and sufficient conditions, quadratic problem, Statement, Wolfe's and Beale's methods.

UNIT-V	GEOMETRIC AND INTEGER PROGRAMMING	Classes : 09

Geometric programming: posynomials, arithmetic, geometric inequality, unconstrained G.P, constrained G.P($\leq$ type only) integer Programming; Introduction, formulation, Gomory cutting plane algorithm, branch and bound method.

Text Books:

1. Kalyanmoy Deb, "Optimization for Engineering Design", Prentice-Hall of India (Pvt) Ltd, New Delhi, 1st Edition, 2005.
2. S.S.Rao," Engineering Optimization: Theory & Practice", New Age International Publications, 3rd Edition, 2003.

Reference Books:

1. S. D. Sharma, "Operations Research", Kedar Nath & Ran Nath Co., New Delhi, 1st Edition, 2013.
2. Beveridge, Schechter, "Optimization Theory & Practice", McGraw-Hill, 1st Edition, 2010.
3. Mohan C. Joshi, K.M Moudgalya, "Optimization Theory & Practice", Narosa Publishing House, 1st Edition, 2013.

Web References:

1. http://www.sandia.gov/~ktcarlb/opt_class/OPT_Lecture1.pdf
2. http://www.ifp.illinois.edu/~angelia/optimization_one.pdf
3. http://www3.imperial.ac.uk/pls/portallive/docs/1/7288263.PDF

E-Text Book:

1. https://pws.yazd.ac.ir/honarvar/Optimizatio-Books/Engineering%20Optimization-Rao.pdf
2 http://www.iitg.ernet.in/rkbc/CE602/CE602/Introduction.pdf

Course Home Page:

ENGINEERING MATERIALS

III Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME517	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Recognize basic nomenclature, basic microstructure, associate terms with the appropriate and also select suitable ferrous and non-ferrous materials for engineering application.
II. Ability to perform phase equilibrium calculation and construct phase diagram.
III. Recognize the effect of composition and microstructure on material properties.
IV. Perform simple calculations to qualify materials properties and micro structural characteristics.
V. Structure / phenomena and be able to differentiate between related structure / phenomena.

UNIT-I	**CLASSIFICATION AND PROPERTIES OF MATERIAL**	**Classes : 09**

Classification of engineering materials, property spectrum of materials, hardness test, tensile test, bend test, impact test, fatigue test, creep test.

UNIT-II	**STRUCTURE OF ENGINEERING MATERIAL**	**Classes : 09**

Atomic structure, crystal structure, crystal imperfection, microstructure, phases in alloys, macrostructure, structure of engineering materials, Dislocations, strengthening mechanism in metals, polycrystalline metals.

UNIT-III	**FERROUS AND NON FERROUS MATERIALS**	**Classes: 09**

Classification of steels and cast iron, microstructure, effect of alloying elements on steel, ferrous alloys and their applications, Factors affecting conductivity of a metal.

Electrical resistivity in alloys, thermal conductivity of metals and alloys, high resistivity alloys, some important Titanium alloys, Nickel alloys, Copper alloys, Magnesium alloys and Aluminium alloys.

UNIT-IV	**ENGINEERING CERAMICS**	**Classes: 09**

Types, Crystal Structures, Silicate Ceramics, Glasses, glass Ceramics, advanced ceramics, functional properties and applications of ceramic materials, SiC, Al2O3, Si3N4, Super hard materials, Tungsten carbide and Boron nitrides, graphene, applications to bio engineering.

UNIT-V	**ENGINEERING POLYMERS**	**Classes : 09**

Classification of polymer, Mechanisms of polymerization, Copolymers, Examples, Defects in polymers Thermoplastics, Thermosets (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes), Engineering plastics, Advanced Polymeric materials, liquid crystal polymers, Conductive polymers, High Performance fibres, Photonic polymers, Elastomers, applications.

Text Books:

1. William D. Callister, Jr., “Materials Science and Engineering an Introduction”, John Wiley & Sons, Inc., 2nd Edition, 2007.
2. V. Raghavan, “Materials Science and Engineering”, Prentice–Hall of India Pvt. Ltd., 2nd Edition, 2013.

Reference Books:
1. Sidney H. Avner, "Introduction to Physical Metallurgy", Tata McGraw-Hill, 2nd Edition, 1997. 2. W. Bolton, "Engineering materials technology", Butterworth & Heinemann, 3rd Edition, 2001. 3. Donald R. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", Thomson Learning, First Indian Reprint, 3rd Edition, 2007.
Web References:
1.https://www.annauniv.edu/academic_courses/%20UG%20C%20&%20S%20WS%20 %2013.3.14(I%20to%20VIII)/02.%20Mechanical/09.%20Material%20sci.pdf
E-Text Book:
1. https://books.google.co.in/books?id=6yr-NMgM6HQC. 2. https://books.google.co.in/books/about/Introduction_to_Engineering_Materials.html?id=kjGjlG6d6.
Course Home Page:

PRODUCTION PLANNING AND CONTROL

III Group: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME518	Elective	L	T	P	C	CIA	SEE	Total
		3	1	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

I. Understand the PPC function in industrial manufacturing scenario.
II. Apply forecasting techniques for different types of products.
III. Knowledge in optimal inventory control and capacity planning.

UNIT-I	OVERVIEW OF PRODUCTION PLANNING CONTROL	Classes : 09

Introduction: Definition, Objectives of production planning and control, functions of production planning and control, elements of production control, types of production, organization of production planning and control department, internal organization of department.

UNIT-II	FORECASTING	Classes : 09

Forecasting: Importance of forecasting, types of forecasting, their uses, general principles of forecasting, forecasting techniques, qualitative methods and quantitive methods; Inventory management, functions of inventories relevant inventory costs ABC analysis, VED analysis, EOQ model, inventory control systems, P-Systems and Q-Systems.

UNIT-III	INTRODUCTION TO MRP	Classes: 09

Introduction to MRP and ERP, LOB (Line of Balance), JIT inventory, and Japanese concepts.

Routing, definition, routing procedure Route sheets, bill of material, factors affecting routing procedure, Schedule, definition, difference with loading.

UNIT-IV	SCHEDULING	Classes: 09

Scheduling Policies, techniques, Standard scheduling methods; Line balancing, aggregate planning, chase planning, expediting, controlling aspects.

UNIT-V	DISPATCHING	Classes : 09

Dispatching: Activities of dispatcher, dispatching procedure, followup, definition, reason for existence of functions, types of followup, applications of computer in production planning and control.

Text Books:

1. M. Mahajan, "Production Planning and Control", Dhanpat Rai, 1st Edition, 2010.
2. Jain, Jain, "Production planning and control", Khanna Publications, 1st Edition, 2012.

Reference Books:

1. S. N. Chary, "Operations Management", Tata McGraw-Hill, 5th Edition, 2013.
2. Chase, "Operation Management", PHI, 1st Edition, 2013.

Web References:
1. http://nptel.ac.in/courses/112107143/
E-Text Book:
1.http://ggnindia.dronacharya.info/ecedept/Downloads/QuestionBank/IIIsem/PRODUCTION%20PLANNING_CONTROL.pdf
Course Home Page:

DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

IV Group: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME519	Elective	3	1	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand basic hydraulic circuits and maintenance.
II. Design hydraulic, pneumatic pumps and circuits.
III. Apply pneumatic and hydraulic systems, automation in industrial equipment.

UNIT-I	OIL AND HYDRAULIC SYSTEMS	Classes : 09

Introduction, history of fluid power, Pascal's law, Bramah's press, Bernoulli's principle, Toricelli principle, fluid principle, fluid properties, viscosity, effect of temperature, dust and decay of oils, basic systems of hydraulic, physical units of fluid power, units of measurement, types of hydraulic fluid and selection criteria, properties of hydraulic fluid, physical characteristic, maintenance of hydraulic oils, oil hydraulic element and their representation in the circuits, comparison of mechanical, electrical, hydraulic and pneumatic systems for force and motion, analysis in automation.

UNIT-II	HYDRAULIC PUMPS	Classes : 09

Classification of pumps, gear pump, types of gear pumps, screw pump, vane pump, types of vane pumps, piston pump, bent axis in line piston pump, internal and external gear pumps, selection and sizing specification of pumps, specification of pumps, pump and pressure pulsation, flow rate and power of hydraulic pump, power and pump efficiencies, pressure, flow efficiencies, oil compatibility, size, noise, pump ripple, checklist; Actuators, design of linear actuator, cushioning, seals, mounting details, piston rod diameter and its effect on the pressure, servo controlled valves, hydraulic balanced circuits, sequencing and synchronizing circuits, rotary actuators.

UNIT-III	HYDRAULIC POWER PACK	Classes: 09

Element of power pack, design of hydraulic power pack, line pressure, discharge and motor.

Selection, power pack size and capacity, importance of pressure relief valve and safety systems, heating and cooling systems for hydraulic power pack.

UNIT-IV	HYDRAULIC CIRCUITS AND ACCUMULATOR	Classes: 09

Hydaulic circuits, manual or automatic hydraulic system, regenerative circuit, use of check valves in hydraulic circuit, selection of pump, standard in circuit, circuit diagram representation, sequencing and synchronizing circuits; accumulator, low cost automation; meter-in circuit, meter-out circuit, bleed-off circuit, direction control valves, solenoid valves, flow control and pressure control valves, pressure compensation, accumulator.

UNIT-V	AUTOMATION	Classes : 09

Hydraulic and pneumatic equipment in automation, low cost automation, relay circuit, programmable logic circuit, automation, micro controller; maintenance and troubleshooting of hydraulic and pneumatic circuit.

Text Books:
1. S. R. Majumdar, “Oil Hydraulic Systems”, Tata McGraw-Hill, 1st Edition, 2013. 2. S. R. Majumdar, “Pneumatic Systems, Principles & Maintainance”, Tata McGraw-Hill, 1st Edition, 2013. 3. T. Jagadeesha, “Hydraulic and Pneumatics”, I. K Publishing House (Pvt). Ltd, 1st Edition, 2013.
Reference Books:
1. Andrew Parr, “Hydraulic & Pneumatic”, Butterworth-Heinemann Ltd, 2nd Edition, 2013. 2. Antony Esponssito, “Fluid Power with applications”, Prentice Hall, 5th Edition, 2015.
Web References:
1. http://nptel.ac.in/courses/112105046 2. http://www.nptel.ac.in/courses/112106175/Module%201/Lecture%201.pdf 3. http://hydraulicspneumatics.com/fluid-power-basics
E-Text Book:
1.https://www.google.co.in/?gfe_rd=cr&ei=weV5V8HrNKLR8AeNgr7gBw&gws_rd=ssl#q=hydraulic+and+pneumatics+andrew+parr+pdf 2.https://books.google.co.in/books/about/Oil_Hydraulic_Systems.html?id=NBMtphgTmxgC&redir_esc=y 3.http://www.faa.gov/regulations_policies/handbooks_manuals/aircraft/amt_airframe_handbook/media/ama_ch12.pdf

DESIGN FOR MANUFACTURING AND ASSEMBLY

IV Group: ME									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME520	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand various general design rules for manufacture ability and criteria for material selection.
II. Apply various machining process and tolerance aspects in machining.
III. Analyze the design considerations for casting and welding process.
IV. Apply the conceptual design factors to be considered in forging, extrusion and sheet metal work, design guidelines for manual assembly and development of DFA methodology.

UNIT-I	INTRODUCTION	Classes : 09

Introduction**:** Design philosophy, steps in design process, general design rules for manufacture ability, basic principles of designing for economical production, creativity in design; materials: Selection of materials for design, developments in material technology, criteria for material selection, material selection interrelationship with process selection, process selection charts.

UNIT-II	DESIGN FOR MACHINING, CASTING	Classes : 09

Machining Process: Overview of various machining processes, general design rules for machining, dimensional tolerance and surface roughness, design for machining ease, redesigning of components for machining ease with suitable examples, general design recommendations for machined parts.

UNIT-III	DESIGN FOR JOINING, FORMING	Classes: 09

Metal casting**:** Appraisal of various casting processes, selection of casting process, general design considerations for casting, casting tolerances, use of solidification Simulation in casting design, product design rules for sand casting.

Metal Joining: Appraisal of various welding processes, factors in design of weldments, general design guidelines, pre and post treatment of welds, effects of thermal stresses in weld joints, design of brazed joints.

UNIT-IV	DESIGN FOR FORGING	Classes: 09

Forging**:** Design factors for forging, closed die forging design, parting lines of dies, drop forging die design, general design recommendations extrusion; Sheet metal work: Design guidelines for extruded sections, design principles for punching, blanking, bending, deep drawing, Keeler Goodman forming limit diagram, component design for blanking.

UNIT-V	DESIGN FOR ASSEMBLY AND AUTOMATION	Classes : 09

Design for assembly: General design guidelines for manual assembly, development of systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time.

Text Books:

1. Geoffrey Boothroyd, “Assembly Automation and Product Design”, Marcel Dekker Inc., NY, 1st Edition, 2013.
2. George E, Dieter, “Engineering Design - Material & Processing Approach”, McGraw-Hill, 2nd Edition, 2000.
3. Geoffrey Boothroyd, “Hand Book of Product Design”, Marcel and Dekken, 1st Edition, 2013.
4. Geoffrey Boothroyd, Peter Dewhurst, Winston “Product Design for Manufacturing and Assembly”, CRC Press, 1st Edition, 2010.

Reference Books:

1. Geoffrey Boothroyd, “Hand Book of Product Design”, Marcel and Dekken, 1st Edition, 2013.
2. Geoffrey Boothroyd, Peter Dewhurst, Winston “Product Design for Manufacturing and Assembly”, CRC Press, 1st Edition, 2010.

Web References:

1. http://www.nptel.ac.in/courses/107103012/
2. http://nptel.ac.in/courses/112101005/

E-Text Book:

1. http:// www.sciencedirect.com/science/book/9780750673419
2. http:// www.faadooengineers.com/.../11227-Amie-Fundamental-of-design-and-manufacturin...

Course Home Page:

DESIGN AND ANALYSIS OF COMPOSITE STRUCTURES

IV Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME521	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Gain knowledge in the analysis of Multi layered composite laminated plates using micromechanics properties of composites materials.
II. Determination of mechanical properties of laminates using Hooke‘s Law.
III. Analyze stresses in classical and laminated plates with symmetric, anti-symmetric and un-symmetric layered composites.

UNIT-I	**INTRODUCTION TO LAMINATED COMPOSITES**	**Classes : 09**

Introduction to laminated composite plates, mechanical properties of constituent materials such as matrix and filaments of different types.

UNIT-II	**ANALYSIS OF COMPOSITE MATERIALS**	**Classes : 09**

Netting analysis of composite materials, determination of properties of laminates with fibers and matrices.

UNIT-III	**STRESS STRAIN RELATIONSHIPS**	**Classes: 09**

Stress-Strain relations of isotropic, Orthotropic and anisotropic materials.

Transformation of material properties for arbitrary orientation of fibres.

UNIT-IV	**METHODS OF ANALYSIS**	**Classes: 09**

Methods of analysis: Mechanics of materials approach to determine Young‘s modulus, shear modulus and Poisson‘s ratio, brief mention of elasticity approach and macro mechanics of laminates; Anisotropic elasticity, stress–strain relations in material coordinates, transformation of geometric axes, strength concepts, biaxial strength theories, maximum stress and maximum strain.

UNIT-V	**ANALYSIS OF LAMINATED PLATES**	**Classes : 09**

Analysis of laminated plates**:** Classical plate theory, classical lamination theory, special cases of single layer, symmetric, anti-symmetric and unsymmetric composites with cross ply, angle ply lay up. Deflection analysis of laminated plates; Analysis laminated beam and plates, shear deformation theories for composite laminated beams, plates; Buckling analysis of laminated composite plates with different orientation of fibres . Tsai-wu criteria and Tsai–Hill Criteria.

Text Books:

1. Jones R. M, “Mechanics of Composite Materials”, McGraw Hill Kogakusha, Ltd. Tokyo, 1975.
2. Mudhujith Mukhopadhyay, “Mechanics of Composite Materials and Structures”, University Press, 2001.

Reference Books:
1. Agarwal B.D, Broutman. L.J, “Analysis and performance of fibre composites”, John Wiley and sons, 3rd Edition, 2006. 2. Lubin. G, Von.Nostrand, “Hand Book on Advanced Plastics and fibre glass”, Reinhold Co. New York, 1989. 3. Lalith Gupta, “Advanced Composite Materials”, Himalayan book, New Delhi, 1998. 4. Kishan K. Chawla, “Composite Materials”, Springer, 1st Edition, 2013.
Web References:
1. www.nptel.ac.in/syllabus/syllabus_pdf/113107046.pdf 2. www.nptel.ac.in/courses/101104010/40
E-Text Book:
1. www.ethesis.nitrkl.ac.in/5878/1/110ME0335-6.pdf 2. https://www.lib.ucdavis.edu/dept/pse/resources/fulltext/HDBK17-3F.pdf
Course Home Page:

ADVANCED STRENGTH OF MATERIAL

IV Group: ME									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME522	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the principle of shear centre for un-symmetrical sections.
II. Apply the wrinkle batch formula for curved beam theory.
III. Compare stresses in a shaft under torsion and in thin cylindrical members.
IV. Visualize shear stress flow in non-circular shaft members.

UNIT-I	SHEAR CENTRE	Classes : 09

Bending axis and shear center, shear center for axi-symmetric and unsymmetrical sections bending: Bending stresses in beams subjected to nonsymmetrical bending, deflection of straight beams due to nonsymmetrical bending.

UNIT-II	CURVED BEAM THEORY	Classes : 09

Winkler bach formula for circumferential stress, limitations, correction factors, radial stress in curved beams, closed ring subjected to concentrated and uniform loads, stresses in chain links.

UNIT-III	TORSION	Classes: 09

Torsion of a cylindrical bar of circular cross section; Saint venants ‘semi inverse methods, linear elastic solution, prandtl elastic membrane (soap film) analogy, Narrow rectangular cross section, hollow thin wall torsion members, multiply connected cross section.

Thin wall torsion members with restrained ends axi-symmetric problems: Rotating discs, flat discs, discs of uniform thickness, discs of uniform strength, rotating cylinders.

UNIT-IV	THEORY OF PLATES	Classes: 09

Introduction: Stress resultants in a flat plate, kinematics: Strain displacement relations for plates, equilibrium equations for small displacement theory of flat plates, stress strain temperature relation for isotropic plates, strain energy of a plate, boundary conditions for plate, solution of rectangular plate problem, solution of circular plate problem; Beams on elastic foundation: general theory, infinite beam subjected to concentrated load, boundary conditions, infinite beam subjected to a distributed load segment, semi infinite beam with concentrated load near its end, short beams.

UNIT-V	CONTACT STRESSES	Classes : 09

Introduction, problem of determining contact stresses, assumptions on which a solution for contact stresses is based, expressions for principal stresses, methods of computing contact stresses, deflection of bodies in point contact, stresses for two bodies in contact over narrow rectangular area (line contact), loads normal to area, stresses for two bodies in line contact, normal and tangent to contact area.

Text Books:
1. Arthur P. Boresi, Richard, J. Schmidt, “Advanced Mechanics of materials” wiley international, 6th Edition,2003. 2. J. P. Den Hortog, “Advanced strength of materials”, Dover Publications, 1st Edition, 2012. 3. Timoshenko, “Theory of Plates”, Tata McGraw-Hill, 1st Edition, 2013.
Reference Books:
4. Stephen P. Timoshenko, S. Woinowsky Kriger, “Theory of Plates and Shells”, Tata McGraw-Hill, 2nd Edition, 2013. 2. James. O. Seely, Smith, B. Fred, “Advanced Mechanics of materials, John Willey, 1st Edition, 1967.
Web References:
1. http://nptel.ac.in/courses/105106049/pdf-assignments/main.pdf 2. http://www.nptel.ac.in/syllabus/105101003/ 3. http://numgeom.ams.sunysb.edu/shells/ThinPlatesAndShellsTheory
E-Text Book:
1. https://books.google.co.in/books/about/Advanced_mechanics_of_materials.html 2. http://155.207.34.6/files/Timoshenko.pdf 3. https://books.google.co.in/books/about/Strength_of_Materials.html?id=S5A-sZgcYM0C
Course Home Page:

MACHINE DYNAMICS

IV Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME523	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes: 45**			

OBJECTIVES:

The course should enable the students to:

I. Understand the concepts and broad principles of machine tool design.
II. Apply the concept of regulation of speed and speed regulation.
III. Calculate and performances of machine working and efficiencies.
IV. Design the machine tool structure, dynamics of machine tools.

UNIT-I	INTRODUCTION TO MACHINE TOOL DRIVES	Classes : 09

Types and capabilities of machine tools, Constructional and operational features, General requirements of Machine tool design, working and auxiliary motions in machine tools, kinematics of machine tools, motion transmission, mechanical, hydraulic and electric drives, aim of speed and feed regulation, layout of speed change gears, saw diagrams for arithmetic, geometric, harmonic and logarithmic progression of spindle speeds.

UNIT-II	REGULATION OF SPEED AND FEED RATES	Classes : 09

Establishment of gear ratios, layout of the intermediate reduction gears, calculation of transmission ratios, pulley diameter, gear wheel diameters and number of teeth, ray diagram, speed chart, design of speed gear boxes, feed drives, feed box design, functions of machine tool structures and their requirements.

UNIT-III	DESIGN OF MACHINE TOOL STRUCTURES AND DESIGN OF GUIDE WAYS AND POWER SCREWS	Classes: 09

Design criteria for machine tool structures, materials of machine tool structures, static and dynamic stiffness, profiles of machine tool structures.

Basic design, procedure of machine tool structures, design of beds, columns, saddles, carriages, bases and tables.

UNIT-IV	DESIGN OF SPINDLES, SPINDLE SUPPORTS AND DYNAMICS OF MACHINE TOOLS	Classes: 09

Functions of spindles and requirements, effect of machine tool compliance on machining accuracy, design of spindles, antifriction bearings; Machine tool elastic system, static and dynamic stiffness, effects of vibration, stability analysis; Methods to reduce instability in machine tool like dampers, vibration absorbers etc, machine tool chatter.

UNIT-V	CONTROL SYSTEMS IN MACHINE TOOLS, ERGONOMICS AND AESTHETIC DESIGN OF MACHINE TOOLS	Classes : 09

Machine tool control systems, control systems for speed and feed changing, adaptive control systems, ergonomics and aesthetic design of machine tool, recent trends of machine tool.

Text Books:

1. N. K. Mehta, "Machine Tool Design and Numerical Control", McGraw-Hill, 3rd Edition, 2013.
2. CMTI, "Machine Tool Design Handbook", McGraw-Hill, 1st Edition, 2013.

Reference Books:
1. S. K. Basu, “Machine Tool Design”, Oxford, 6^{th} Edition, 2014. 2. Sen, Bhattacharya, “Machine Tool Design”, CBS Publications, 6^{th} Edition, 2013.
Web References:
1. http://www.nptel.ac.in/downloads/112105127/ 2. https://www.youtube.com/watch?v=1a2DGySH2iI
E-Text Book:
1. https://books.google.co.in/books/about/Machine_Tool_Design.html?id. 2. http://www.nitc.ac.in/dept/me/jagadeesha/Tool_Engineering...Design/CHAPTER14.pdf
Course Home Page:

MECHANICAL VIBRATIONS

IV Group: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME524	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand basic concepts of mechanical vibrations and phenomena of transmissibility
II. Analyze mechanical systems with/ without damping for 1/ multi degrees of freedom environment.
III. Application of vibration measuring instruments and machine monitoring systems.
IV. Develop competency in analytical methods in solving problems of vibrations along with mode shapes.

UNIT-I	SINGLE DEGREE OF FREEDOM SYSTEMS	Classes : 09

Single degree of freedom systems: Undamped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility, response to non Periodic Excitations: Unit impulse, unit step and unit ramp functions; response to arbitrary excitations, the convolution integral; shock spectrum; System response by the laplace transformation method.

UNIT-II	TWO DEGREE FREEDOM SYSTEMS	Classes : 09

Two degree freedom systems: Principal modes, undamped and damped free and forced vibrations; undamped vibration absorbers.

UNIT-III	MULTI DEGREE FREEDOM SYSTEMS	Classes: 09

Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis.

Method of matrix inversion; Torsional vibrations of multi-rotor systems and geared systems; Discrete-Time systems; Vibration measuring instruments: Vibrometer, velocity meters and accelerometers.

UNIT-IV	FREQUENCY DOMAIN VIBRATION ANALYSIS	Classes: 09

Frequency domain vibration analysis: Overview, machine train monitoring parameters, data base development, vibration data acquisition, trending analysis, failure node analysis, root cause analysis.

UNIT-V	NUMERICAL METHODS	Classes : 09

Numerical methods: Raleigh’s stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods

Text Books:

1. Singiresu S Rao, “Mechanical Vibration”, 4th Edition, 2013.
2. G. K. Grover, “Mechanical Vibration”, Nemchand & Brothers, 8th Edition, 2009.
3. J.S. Rao and K. Gupta, “Introductory Course On Theory & Practice Of Mechanical Vibrations”, New Age International (p) Ltd , 2nd Edition, 2012
4. Leonard Meirovitch, “Elements of vibration analysis”, Tata McGraw-Hill, 2nd Edition, 2007.
5. John S. Mitchell, “Introduction to Machinery Analysis and Monitoring”, Pennwell books, 2nd Edition, 1993.

Reference Books:

1. Singh V. P, “Mechanical Vibration”, Dhanpat Rai & Co (p) Ltd, 3rd Edition, 2012.
2. AD Dimarogonas, SA Paipetis, “Analytical Methods In Rotor Dynamics”, Applied Science Publishers London, 1983.
3. J. S. Rao, “Rotor Dynamics”, New Age International (p) Ltd., 3rd Edition, 2012.
4. B.C. Nakra and K. K. Chowdary, “Mechanical Measurements”, 2nd Edition, Tata McGraw-Hill, New Delhi, 2004
5. Collacott, R.A., “Mechanical Fault Diagnosis and Condition Monitoring”, 1st Edition, Chapman and Hall, London, 1977.

Web References:

1. http://www.math.psu.edu/tseng/class/Math251/Notes-MechV.pdf
2. https://engineering.purdue.edu/~deadams/ME563/notes_10.pdf
3. http://nptel.ac.in/courses/112103111/#
4. https://engfac.cooper.edu/pages/tzavelis/uploads/Vibration%20Theory.pdf
5. http://vdol.mae.ufl.edu/CourseNotes/EML4220/vibrations.pdf

E-Text Book:

1. http://sv.20file.org/up1/541_0.pdf
2. https://aerocastle.files.wordpress.com/2012/10/mechanical_vibrations_5th-edition_s-s-rao.pdf
3. http://freshersclub.in/mechanical-vibrations-by-v-p-singh-pdf/

Course Home Page:

SOLAR ENERGY SYSTEMS

V Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME525	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the student to:

I. Understand the concept related various laws in solar engineering.
II. Outline the basic idea of solar energy collecting as well as energy storage devices.
III. Development of solar cells and photo voltaic cells.

UNIT-I	INTRODUCTION TO SOLAR ENERGY	Hours: 09

Basics of solar energy, brief history of solar energy utilization, various approaches of utilizing solar energy, blackbody radiation, relation between radiation field energy density and radiation spectrum, Planck's formula in energy unit, maximum spectral density ; Planck's formula in wavelength unit , Wien displacement law, Stefan- Boltzmann law; Photoelectric effect , Einstein's theory of photons, Einstein's derivation of the black body formula.

UNIT-II	ORIGIN OF SOLAR ENERGY,TRACKING SUNLIGHT AND ATMOSPHERIC INTERACTION	Hours: 09

Basic parameters of the sun, measurement of the solar constant, the structure of the Sun, the origin of solar energy, rotation and orbital motion of the earth around the sun; solar time, sidereal time, universal standard time, local standard time, equation of time, intensity of sunlight on an arbitrary surface at any time, interaction with the atmosphere, absorption of the molecules, air mass, rayleigh scattering, direct and scattered sunlight.

UNIT-III	SOLAR CELLS, PHOTOVOLTAIC BASICS	Hours: 09

Formation of a p-n junction, space charge and internal field, quasi Fermi levels, the Shockley diode equation, structure of a solar cell , the solar cell equation, fill factor and maximum power, various electron hole pair recombination mechanisms, crystalline silicon solar cells; Thin film solar cells: CIGS, cite and a silicon Tandem solar cells, dye sensitized solar cells, organic solar cells.

Structure and working of Solar Cells, types, electrical properties and behavior of Solar cells, cell properties and design, PV cell interconnection and module fabrication, PV modules and arrays, basics of load estimation.

UNIT-IV	SOLAR ENERGY	Hours: 09

Solar radiation at the earth's surface, solar radiation measurements, estimation of average solar radiation , solar thermal flat plate collectors , concentrating collectors, solar thermal application, heating, cooling, desalination, drying, cooking etc.,solar thermal electric power plant , principle of photovoltaic conversion of solar energy, types of solar cells; photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping etc, solar PV power plant, net metering concept.

UNIT-V	CONCENTRATION OF SOLAR ENERGY, ENERGY STORAGE	Hours: 09

Three types of imaging optics: trough or linear collectors, central receiver with heliostats, and parabolic dish concentrator with on axis tracking, solar thermal electricity using stirling engine or ranking engine, solar photovoltaic's with concentration; necessity of storage for solar energy, chemical energy storage, thermal energy storage, thermal flywheels, compressed air, rechargeable batteries.

Text Books:
1. Duffie, J.A., Beckman, W.A. , "Solar Energy Thermal Process", John Wiley and Sons, 2007. 2. Jui Sheng Hsieh, "Solar Energy Engineering", Prentice-Hall, 1st Edition, 2007. 3. M. Stix, "The Sun, An Introduction", Springer, 2nd Edition, 2002. 4. G. D. Rai, "Solar Energy Utilization", Khanna Publishers, 1st Edition, 2010. 5. B. G. Streetman, S.Banerjee, " Solid state Electronic Devices", Prentice Hall, 6th Edition, 2006. 6. S.P. Sukhatme, "Solar Energy", Tata McGraw-Hill, 1st Edition, 1984.
Reference Books:
1. C S Solanki, "Solar Photovotaics–Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., 2011. 2. Solar Energy International, "Photovoltaics: Design and Installation Manual", Solar Energy International, 1st Edition, 2010.
Web References:
1. www.nptel.ac.in/courses/112105051 2. www.freevideolectures.com › Mechanical › IIT Kharagpur
E-Text Books:
1. http://www.free-ebooks.net/ebook/Solar-Energy-Simplified 2. http://www.e-booksdirectory.com › Science

NON DESTRUCTIVE TESTING

IV Group: ME									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME526	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes:45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Apply the techniques of surface non destructive techniques testing methods.
II. Apply of ultrasonic, radiographic techniques.
III. Understand advanced NDT technique.

UNIT-I	SURFACE NDE METHODS	Classes: 09

Visual examination, direct and indirect methods, equipment, codes and standards, liquid penetrant testing, variables, interpretation and evaluation of test results, applicable codes and standards, magnetic particle testing, principle, equipment, advantages and limitations.

UNIT-II	ULTRASONIC TESTING	Classes: 09

Principle of ultrasonic testing, methods, equipment, evaluation, interpretation, applications.

UNIT-III	RADIOGRAPHIC TESTING	Classes: 09

Principles, films, radiography equipment, variables, radiographic image quality, techniques, safety.

UNIT-IV	ADVANCED NDE TECHNIQUES-I	Classes: 09

Principle of phase array, technique, equipment, verification of flow existence and position, reporting, application, special radiographic techniques and interpretation of radiography, advantages and limitations.

UNIT-V	ADVANCED NDE TECHNIQUES-II	Classes: 09

Acoustic, emission inspection, principles and applications, leak testing, principles and applications, industrial computed tomography principles and applications.

Text Books:

1.ASM, “Non–destructive examination and quality control”, ASM International, volume17, 9th Edition, 1989.
2. J. Prasad, C.G.K Nair, “Non-destructive Test and Evaluation of materials”, Tata McGraw-Hill, 2nd Edition, 2011.
3. J. Krautkramer, H. Krautkramer, “Ultrasonic Testing of material”, Springer, 4th Edition, 1990.
4. R. Halshaw, “Industrial Radigraphy: Theory and Practice”, Springer, 2nd Edition, 1995.

Reference Books:

1. B. Raj, T. Jayakumar, M. Thavasinumuthu, “Practical Non-destructive Testing”, Alpha science International Limited, 3rd Edition, 2002.
2. R. Halshaw, “Industrial Radigraphy: Theory and Practice”, Springer, 2nd Edition, 1995.

Web References:

1. http://www.nptel.kmeacollege.ac.in/syllabus/125106002/
2. http://www.nptel.ac.in/courses/125106002/

E-Text Books:

1. https://scholar.google.co.in/scholar?q=non+destructive+testing

Course Home Page:

MECHANICAL MEASUREMENTS

V Group: ME									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME527	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand the need for measurement of important quantaties.
II. Analyze system reponse.
III. Evaluate various measurement techniques for engineering applications.

UNIT-I	INTRODUCTION TO MECHANICAL MEASUREMENTS	Classes : 09

Need of mechanical measurement, basic definitions: Hysteresis, linearity, resolution of measuring instruments, threshold, drift zero stability, loading effect and system response, measurement methods, generalized measurement system, static performance characteristics, errors and their classification.

UNIT-II	FUNDAMENTALS OF MEASUREMENTS	Classes : 09

Elements of a generalized measurement system, standards, and types of signals; Static performance characteristics, dynamic performance, instrument types , zero, first and second order instruments, transfer function representation, system response to standard input signals, step, ramp, impulse, and frequency response; Treatment of uncertainties: error classification, systematic and random errors, statistical analysis of data, propagation and expression of uncertainties.

UNIT-III	MEASUREMENT OF VARIOUS PHYSICAL QUANTITIES:	Classes: 09

Measurement of various physical quantities: Linear and angular displacement, velocity, force, torque, strain, pressure.

Flow rate and temperature; Transfer functions of some standard measuring devices.

UNIT-IV	DATA ACQUISITION AND PROCESSING	Classes: 09

Data Acquisition and processing: Digital methods, digitization, signal conditioning, interfacing, standard methods of data analysis, quantities obtainable from time series; Fourier spectra, DFT, FFT; Data acquisition parameters, sampling rate, Nyquist sampling frequency, aliasing and leakage errors; Metrology: measurement of angles, threads, surface finish, inspection of straightness, flatness and alignment, gear testing, digital readouts, coordinate measuring machine.

UNIT-V	METROLOGY	Classes : 09

Metrology: measurement of angles, threads, surface finish, inspection of straightness, flatness and alignment, gear testing, digital readouts, coordinate measuring machine.

Text Books:

1. E. O. Doebelin, “Measurement systems- Applications and Design”, Tata McGraw-Hill, 4th Edition, 1990.
2. T.G. Beckwith, R. D. Marangoni, J.H. Lienhard, “Mechanical Measurements”, Addison Wesley, 5th Edition, 1993.

Reference Books:
1. R.S. Figiola, D. E. Beasley, "Theory and Design for Mechanical Measurements", John Wiley, 2nd Edition, 1995. 2. J.W. Dally, W.F. Riley, K. G. McConnell, "Instrumentation for Engineering Measurements", John Wiley & Sons, 2nd Edition, 1993. 3. E.O. Doebelin, "Engineering Experimentation", McGraw-Hill, 1995. 4. R. K. Jain, "Engineering Metrology", Khanna Publishers, New Delhi, 1997.
Web References:
1. http://www.nptel.ac.in/downloads/112105127/ 2. https://www.youtube.com/watch?v=1a2DGySH2iI
E-Text Book:
1. https://books.google.co.in/books/about/Machine_Tool_Design.html?id. 2. http://www.nitc.ac.in/dept/me/jagadeesha/Tool_Engineering...Design/CHAPTER14.pdf
Course Home Page:

EXPERIMENTAL METHODS

Group V: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME528	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the concept of measurement and accuracy.
II. Apply the usage of mechanical and electrical principles in measurement.
III. Evaluate various testing methods.

UNIT-I	MEASUREMENTS	Classes : 09

Measurements**:** Principles of measurements, accuracy, sensitivity and range of measurements.

UNIT-II	EXTENSOMETERS	Classes : 09

Extensometers: Mechanical, optical, acoustical and electrical extensometers and their uses, advantages and disadvantages.

UNIT-III	ELECTRICAL RESISTANCE STRAIN GUAGES	Classes: 09

Electrical resistance strain gauges**:** Principle of operation and requirements, types and their uses, materials for strain gauge, calibration and temperature compensation.

Cross sensitivity, rosette analysis, wheatstone bridge and potentiometer circuits for static and dynamic strain measurements.

UNIT-IV	PHOTOELASTICITY	Classes: 09

Photoelasticity**:** Two dimensional photoelasticity, concepts of light-photo-elastic effects, stress optic law, interpretation of fringe pattern, compensation and separation techniques, photoelastic materials, introduction to three dimensional photoelasticity.

UNIT-V	NON DESTRUCTIVE TESTING	Classes : 09

Non-destructive testing**:** Fundamentals of NDT, radiography, ultrasonics, magnetic particle inspection, fluorescent penetrant technique, eddy current testing, acoustic emission technique, fundamentals of brittle coating methods, introduction to Moire techniques, holography, ultrasonic C-Scan, thermography, fibre-optic Sensors.

Text Books:

1. Dally.J.W and Riley.W.F, “Experimental Stress Analysis”, McGraw-Hill Inc., New York, 1978.
2. Hetyenyi.M, “Hand Book of Experimental Stress Analysis”, John Wiley and Sons Inc., New York, 1972.

Reference Books:

1. Srinath.L.S, Raghava.M.R, Lingaiah, Gargesha.K, G.Pant.B Ramachandra.K, “ Experimental Stress Analysis”, Tata McGraw Hill, New Delhi, 1st Edition, 2013.
2. Pollock.A.A, “Acoustic Emission in Acoustics and Vibrations Progress’, 1st Edition, 2010.

Web References:
1. https://onlinecourses.nptel.ac.in/noc16_mm07 2. http://nptel.ac.in/courses/113106070
E-Text Book:
www.a-zshiksha.com/forum/viewtopic.php?f=148&t=61439
Course Home Page:

SURFACE ENGINEERING

V Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME529	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand the importance, need of surface engineering and review past, present and future status of surface engineering.
II. Analyze the factors responsible for damage of the surfaces by corrosion, wear, and wear mechanisms.
III. Comprehend the laser processing, electrons & ion beam processing of surfaces, to characterize and evaluate coatings.
IV. Evaluate economics, energy consumption in designing surface engineering processes.

UNIT-I	FUNDAMENTALS OF SURFACE ENGINEERING	Classes : 09

Introduction: Engineering components, surface dependent properties and failures, importance and scope of surface engineering in metals; Surface and surface energy, structure and types of interfaces, surface energy and related equations; Surface dependent engineering properties, wear, friction, corrosion, fatigue, reflectivity, emissivity; Common surface initiated engineering failures, mechanism of surface degradation; importance and necessity of surface engineering.

UNIT-II	CONVENTIONAL SURFACE ENGINEERING	Classes : 09

Surface engineering by material removal, cleaning, pickling, etching, grinding, polishing, buffing/puffing, role and estimate of surface roughness; Carburising, nitriding, cyaniding, diffusion coating, hot dipping, galvanizing etc.; electrochemistry and electro-deposition; Scope and application of conventional surface engineering techniques in engineering materials; advantages and limitations of conventional process; Recent trend in surface engineering: physical/chemical vapour deposition; plasma spray coating; plasma assisted ion implantation; surface modification by directed energy beams like ion, electron and laser beams; energy transfer, beam configuration and modes, surface integration.

UNIT-III	SCOPE OF SURFACE ENGINEERING IN METALS	Classes: 09

Classification and scope of surface engineering in metals, ceramics, polymers and composites, tailoring of surfaces of advanced materials; Surface protection (Physical); surface modification (Chemical) techniques: classification, principles, methods, and technology; conventional surface engineering methods: heat and mass transfer (composition and temperature profile) during directed energy beam irradiation.

Novelty of composition and microstructure; post irradiation characterization (microstructural and compositional) and testing/evaluation of surface-properties; Structure-property correlation. Economics and energy considerations, designing of surface engineering processes.

UNIT-IV	SURFACE ENGINEERING BY ENERGY BEAMS	Classes: 09

Surface engineering by energy beams: General classification, scope and principles, types and intensity/energy deposition profile, Surface engineering by energy beams: Laser assisted microstructural sodification, surface melting, hardening, shocking and similar processes, surface engineering by energy beams: Laser assisted compositional modification surface alloying of steel and non-ferrous metals and alloys, surface engineering by energy beams: Laser assisted compositional modification surface cladding, composite surfacing and similar techniques; Surface engineering by energy beams: Electron beam assisted modification and joining; Surface engineering by energy beams: Ion beam, assisted microstructure and compositional, modification, Surface engineering by spray techniques: Flame spray (principle and scope of application), Surface engineering by spray techniques: Plasma coating (principle and scope of application); Surface engineering by spray techniques: HVOF, cold spray (principle and scope of application), characterization of surface microstructure and properties (name of the techniques and brief operating principle).

UNIT-V	SURFACE COATINGS AND MODIFICATION	Classes : 09

Evaporation -Thermal / Electron beam, sputter deposition of thin films and coatings DC and RF Sputter deposition of thin films and coatings, magnetron and ion beam, hybrid/Modified PVD coating processes, chemical vapor deposition and PECVD, Plasma and ion beam assisted surface modification, surface modification by ion implantation and ion beam mixing.

Text Books:

1. P.H Morton, “Surface Engineering & Heat Treatment”, I.I.T, Brooke field, 1st Edition, 1991.
2. ASM, “Metals Handbook Surface Cleaning, Finishing & Coating”, 9th Edition, 1982.

Reference Books:

1. M. G. Fontana, “Corrosion Engineering”, McGraw-Hill, 3rd Edition, 2013.

Web References:

1. http://nptel.ac.in/syllabus/113108051/
2. http:// www.cdeep.iitb.ac.in/.../nptel/.../Engineering%20Chemistry%201/Course_home_Lec2

E-Text Book:

1. http://dl.iranidata.com/.../Mars%20Fontana-Corrosion%20Engineering(www.iranidata.com).

Course Home Page:

TRIBOLOGY

V Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME530	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Basic knowledge about different methods of surface modification and surface treatment
II. In-depth understanding of how different material structures affects the surface properties
III. Knowledge of different physical laws and chemical reactions which affects the physical and mechanical properties of material surfaces
IV. In-depth understanding of tribological processes and knowledge of other aspects of the surface performance
V. Basic knowledge of different analytical techniques for surface analysis and characterization of their performance.

UNIT-I	SURFACE INTERACTION AND FRICTION	Classes : 09

Topography of Surfaces, surface features, properties and measurement, surface interaction, adhesive theory of sliding friction, rolling friction, friction properties of metallic and non-metallic materials, friction in extreme conditions, thermal considerations in sliding contact.

UNIT-II	WEAR AND SURFACE TREATMENT	Classes : 09

Types of wear, mechanism of various types of wear, laws of wear, theoretical wear models, wear of metals and non metals, surface treatments, surface modifications, surface coatings methods, surface topography measurements, laser methods, instrumentation, international standards in friction and wear measurements.

UNIT-III	LUBRICANTS AND LUBRICATION REGIMES	Classes: 09

Lubricants and their physical properties, viscosity and other properties of oils, additives and selection of lubricants, lubricants standards ISO, SAE, AGMA, BIS standards.

Lubrication regimes, solid lubrication, dry and marginally lubricated contacts, boundary lubrication hydrodynamic lubrication, elasto and plasto hydrodynamic, magneto hydrodynamic lubrication, hydro static lubrication, gas lubrication.

UNIT-IV	CORROSION	Classes: 09

Introduction, principle of corrosion , classification of corrosion, types of corrosion, factors influencing corrosion, testing of corrosion, in-service monitoring, simulated service, laboratory testing, evaluation of corrosion, prevention of corrosion, material selection, alteration of environment, design, cathodic and anodic protection, corrosion inhibitors.

UNIT-V	ENGINEERING MATERIALS	Classes : 09

Introduction, advanced alloys, super alloys, titanium alloys, magnesium alloys, aluminium alloys, and nickel based alloys, ceramics, polymers, biomaterials, applications, bio-tribology and nano-tribology.

Text Books:

1. G.W.Stachowiak, A.W. Batchelor, "Engineering Tribology", Butterworth-Heinemann, UK, 2005.
2. Rabinowicz. E, "Friction and Wear of materials", John Willey &Sons, UK, 1995.

Reference Books:

1. S. K. Basu, S. N.Sengupta, B. B. Ahuja ,"Fundamentals of Tribology", Prentice–Hall of India Pvt Ltd, New Delhi, 2005.
2. Williams J.A. "Engineering Tribology", Oxford University Press, 1994.

Web References:

1. http://www.tribology-abc.com/
2. https://ocw.mit.edu/courses/mechanical-engineering/2-800-tribology-fall-2004/index.htm

E-Text Book:

1. http://www.asminternational.org/documents/10192/3454476/ACFAA73.pdf/cdfc952b-62aa-477d-9bb2-3abb823a652d
2. http://as.wiley.com/WileyCDA/WileyTitle/productCd-047063927X.html

Course Home Page:

MECHATRONICS

VI Group: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME531	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand basic mechatronics system, design and their structure, mechanism, ergonomic and safety.
II. Apply the theoretical and practical aspects of computer interfacing and real time data acquisition and control.
III. Understand the fundamentals of PLC.

UNIT-I	INTRODUCTION TO MECHATRONICS	Classes : 09

Mechatronics systems, elements level of mechatronics system, mechatronics design process, system, measurement system, control system, microprocessor based controller, advantages and disadvantages of mechatronics systems, sensors and transducers, types, displacement, position, proximity, velocity, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II	ELECTRONIC DEVICES	Classes : 09

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC, anlog signal conditioning, amplifiers, filtering, introduction to mems and typical applications.

UNIT-III	HYDRAULIC AND PNEUMATIC ACTUATORS	Classes: 09

Hydraulic and pneumatic actuating systems, fluid systems, hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro pneumatic.

Electro- hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT-IV	DIGITAL ELECTRONIC AND SYSTEMS	Classes: 09

Digital electronics and systems, digital logic control, micro processor and micro controller, programming, process controller, programmable logic controller, PLC's versus computer, application of PLC's or control.

UNIT-V	SYSTEM INTERFACING AND DATA ACCQUISITION	Classes : 09

System interfacing and data acquisition, DAQS, SCADA, A to D, D to A, conversion; Dynamic models and analogies, system response, design of mechatronics system and future trend.

Text Books:

1 W. Bolton, "Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering", Pearson Education Press, 3rd Edition, 2005.
2. M. D. Singh, J. G. Joshi, "Mechatronics", Prentice Hall, 1st Edition, 2013.

Reference Books:
1. C. Braga, “Mechatronics Source Book”, Delmar Learning, 1^{st} Edition, 2013. 2. N. Shanmugam, “Mechatronics”, Anuradha Agencies, 1^{st} Edition, 2009. 3. Devadas Shetty, Richard A. Kolk, “Mechatronics System Design”, Cengage, 1^{st} Edition, 2013. 4.Godfrey C. Onwubolu, “Mechatronics-Principles and Applications”, Butterworth-Heinemann, 1^{st} Edition, 2013.
Web References:
1. www.nptel.ac.in/courses/112103174 2. www.electricalengineeringschools.org/mechatronics/
E-Text Book:
1. http://www.freepdfbook.com/mechatronics-book/ 2. http://www.mechatronic.me/forum/viewforum.php?f=40 3. http://www.freepdfbook.com/introduction-to-mechatronics-and-measurement-systems/
Course Home Page:

AUTOMATION IN MANUFACTURING

VI Group: ME									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME532	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

OBJECTIVES:

The course should enable the students to:

I. Understand the manufacturing and production concepts.
II. Analyze and understand about the automation system.
III. Able to use the automation systems in manufacturing line.

UNIT-I	OVER VIEW OF MANUFACTURING AND AUTOMATION	Classes : 09

Over View of Manufacturing and Automation: Production systems, automation in production systems, Automation principles and strategies, Manufacturing operations, production facilities, basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers and personal computers.

UNIT-II	MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES	Classes : 09

Material Handling and Identification Technologies: Material handling, equipment, analysis, storage systems, performance and location strategies, automated storage systems, AS/RS, types; Automatic identification methods, barcode technology, RFID.

UNIT-III	MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES	Classes: 09

Manufacturing Systems and Automated Production Lines: Manufacturing systems: components of a manufacturing system, single station manufacturing cells; Manual assembly lines.

Line balancing algorithms, mixed model assembly lines, alternative assembly systems; Automated production lines, applications, analysis of transfer lines.

UNIT-IV	AUTOMATED ASSEMBLY SYSTEMS	Classes: 09

Automated assembly systems: Fundamentals, analysis of assembly systems; Cellular manufacturing, part families, cooling, production flow analysis; Group technology and flexible Manufacturing systems, quantitative analysis.

UNIT-V	QUALITY CONTROL AND SUPPORT SYSTEMS	Classes : 09

Quality Control and Support Systems: Quality in design and manufacturing, inspection principles and strategies, automated inspection, contact vs non - contact, CMM; Manufacturing support systems; Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

Text Books:

1. Mikell. P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, PHI, 3rd Edition, 2012.
2. J. P. Groover, “Automation, Production Systems and CIM”, PHI, 1st Edition, 2013.
3. P. Radha Krishnan, S. Subrahamanyarn, Raju, “CAD/CAM/CIM”, New Age International Publishers, 1st Edition, 2003.

Reference Books:
1. Tien-Chien Chang, Richard A. Wysk, Hsu-Pin Wang, “Computer Aided Manufacturing”, Pearson 1st Edition, 2009. 2. R Thomas Wright, Michael Berkeihiser, “Manufacturing and Automation Technology”, Good Heart/Willcox Publishers, 1st Edition, 2013.
Web References:
1. https://www3.nd.edu/~manufact/MPEM_pdf_files/Ch14.pdf 2. http://nptel.ac.in/courses/112102011
E-Text Book:
1. https://docs.google.com/file/d/0B7uir_9DoCLFaGduckFqQmcwUnc/edit?usp=drive 2. https://lehrerfortbilduw.de/faecher/nwt/fb/atechnik/grundlagen/en/kapitel/563060_Fundamentals_of_automation_technology.pdf
Course Home Page:

ROBOTICS

VI Group: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME533	Elective	L	T	P	C	CIA	SEE	Total
		3	1	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand principles of automation and robotics.
II. Comprehend motion analysis kinematics.
III. Apply robotics for different industrials applications.

UNIT-I	INTRODUCTION TO AUTOMATION AND ROBOTICS	Classes : 09

Introduction, automation and robotics, an over view of robotics, classification by coordinate system and control systems, components of the industrial robotics: Degrees of freedom, end effectors: mechanical gripper, magnetic vacuum cup and other types of grippers , general consideration on gripper selection and design, robot actuator and sensors.

UNIT-II	MOTION ANALYSIS	Classes : 09

Motion analysis: Basic rotation matrices, composite rotation matrices, equivalent angle and axis homogeneous transformation, problems; Manipulator kinematics**:** D-H notations, joint coordinates and world coordinates, forward and inverse kinematics, problems.

UNIT-III	DIFFERENTIAL KINEMATICS	Classes: 09

Differential kinematics: Differential Kinematics of planar and spherical manipulators, jacobians, problems; Differential kinematics: Differential Kinematics of planar and spherical manipulators, jacobians, problems.

Robot dynamics: Lagrange, euler formulations, newton-euler formulations, problems on planar two link manipulators.

UNIT-IV	TRAJECTORY PLANNING	Classes: 09

Trajectory planning**:** Joint space scheme, cubic polynomial fit, avoidance of obstacles, types of motion: Slew motion, joint interpolated motion, straight line motion, problems, robot actuators and feedback components: Actuators, pneumatic.

UNIT-V	ROBOT APPLICATIONS	Classes : 09

Robot application in manufacturing: Material handling, assembly and inspection, work cell design.

Text Books:

1. M. P. Groover, “Industrial Robotics”, Pearson, 2nd Edition, 2012.
2. J.J Criag, “Introduction to Robotic Mechanics and Control”, Pearson, 3rd Edition, 2013.

Reference Books:
1. K.S Fu, "Robotics", McGraw-Hill, 1st Edition, 2013. 2. Richard, D.Klafter, Thomas A Chmielewski, Miachael Neigen, "Robotic Engineering An Integrated Approach", Prentice Hall, 1st Edition, 2013. 3. Asada, Slotine, "Robot Analysis and ltelligence", Wiley, 1st Edition, 2013. 4. Mark W. Spong, M. Vidyasagar, I.John, "Robot Dynamics & Control", John Wiley & Sons, 1st Edition, 2013. 5. R. K. Mittal, I.J. Nagrath, "Robotics and Control", Tata McGraw-Hill, 1st Edition, 2011.
Web References:
1. http://nptel.ac.in/courses/112101099/ 2. http://nptel.ac.in/courses/112101099/3
E-Text Book:
1. http://www.intechopen.com/books/robot-control 2. http://www.springer.com/gp/book/9781846286414
Course Home Page:

WIND TUNNEL TESTING TECHNIQUES

VI Group: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME534	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand the need and importance of model testing.
II. Ability to know the basic principle and testing in wind tunnel.
III. Perform calibration of wind tunnel and measurements in wind tunnel.
IV. Recognize the flow visualization techniques in wind tunnel.

UNIT-I	PRINCIPLES OF MODEL TESTING	Classes : 09

Buckingham Theorem, non dimensional numbers, scale effect, geometric kinematic and dynamic similarities.

UNIT-II	WIND TUNNELS	Classes : 09

Classification, special problems of testing in subsonic, transonic, supersonic and hypersonic speed regions, layouts, sizing and design parameters.

UNIT-III	CALIBRATION OF WIND TUNNELS	Classes: 09

Test section speed, horizontal buoyancy, flow angularities.

Turbulence measurements associated instrumentation, calibration of supersonic tunnels.

UNIT-IV	WIND TUNNEL MEASUREMENTS	Classes: 09

Steady and Unsteady Pressure and velocity measurements, force measurements, three component and six component balances, internal balances, principles of hotwire anemometer.

UNIT-V	FLOW VISUALIZAITON	Classes : 09

Smoke and tuft grid techniques, dye injection special techniques, optical methods of flow visualization.

Text Books:

1. Rae, W.H. , Pope, A., "Low Speed Wind Tunnel Testing", John Wiley Publication, 1st Edition, 1984.

Reference Books:

1. Pope, A., Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1st Edition, 1985.

Web References:

1. https://www.scribd.com/doc/118591509/Lecture-Notes-on-Wind-Tunnel-Testing.

E-Text Book:
1. https://books.google.ca/books?hl=en&id=O8FcfVIliwC&dq=maintenance+engineering+handbook&printsec=frontcover&source=web&ots=645OGeEgg&sig=hspdMJ5Oe5Hz4T0qyjdh0XUoYoE&sa=X&oi=book_result&resnum=1&ct=result. 2. https://books.google.co.in/books?id=nxT-wxeVVIQC&redir_esc=y.
Course Home Page:

MAINTENANCE AND SAFTEY ENGINEERING

VI Group: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME535	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand the importance of maintenance and safety engineering in industrial, and others area.
II. Ability to perform basics operation of maintenance and safety engineering.
III. Recognize the inventory control in maintenance and safety engineering.
IV. Understand the quality and safety in industrial area.

UNIT-I INTRODUCTION — **Classes : 09**

Need for maintenance, facts and figures, modern maintenance, problem and maintenance strategy for the 21st century, engineering maintenance objectives and maintenance in equipment life, cycle term and conditions.

UNIT-II MAINTENANCE MANAGEMENT AND CONTROL — **Classes : 09**

Maintenance manual, facility evaluation, functions of effective maintenance, management, maintenance project control methods, maintenance, management project control methods, maintenance e management control indices.

UNIT-III TYPES OF MAINTENANCE — **Classes: 09**

Preventive maintenance, elements of preventive, maintenance program, establishing preventive maintenance program, program evaluation and improvement, PM measures, PM models.

Corrective maintenance, corrective maintenance steps and downtime components, corrective maintenance measure, corrective maintenance models.

UNIT-IV INVENTORY CONTROL IN MAINTENANCE — **Classes: 09**

Inventory control objectives and basic inventory decisions, ABC inventory control method, inventory control models two Bin inventory control and safety stock, spares determinations, factor spares calculation methods.

UNIT-V QUALITY AND SAFTEY IN MAINTENANCE — **Classes : 09**

Need for quality maintenance processes, maintenance work quality, use of quality control chart in maintenance work sampling, post maintenance, guideline to improve safety in maintenance work, safety officer's role in maintenance work, protections of maintenance workers.

Text Books:

1. Andrew K.S.Jardine, Albert H.C.Tsang, "Maintenance, Replacement and Reliability", Taylor and Francis, 2006.

2. Bikas Badhury, S. K.Basu, “Tero Technology: Reliability Engineering and Maintenance Management”, Asian Books, 2003. 3. Seichi Nakajima, “Total Productive Maintenance”, Productivity Press, 1st Edition, 1993.
Reference Books:
1. R. C. Mishra,KK. Pathak, “Maintenance Engineering and Management”, 2nd Edition, 2013. 2. Elsayad, “Reliability Engineering”, Pearson, 1st Edition, 2013.
Web References:
1. http://nptel.ac.in/courses/Webcourse-contents/IISc.../Reliability%20Engg/New_index1.html
E-Text Book:
1.https://books.google.co.in/books/about/Reliability_Maintenance_and_Safety_Engin.html?id=QdFVvZEeo2Wc
Course Home Page:

FLEXIBLE MANUFACTURING SYSTEMS

VI Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME536	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand basic concepts of flexible manufacturing concepts.
II. Apply the flexible manufacturing systems in manufacturing transfer lines.
III. Design the transfer lines in automation systems.

UNIT-I	FMS INTRODUCTION	Classes: 09

FMS introduction: Definition of an FMS, need for FMS, types and configuration, types of flexibilities and performance measures, economic justification of FMS, development and implementation of FMS, planning phases, integration, system configuration, FMS layouts, simulation.

UNIT-II	AUTOMATED MATERIAL HANDLING AND STORAGE	Classes: 09

Functions, types, analysis of material handling systems, primary and secondary material handling systems, conveyors, automated guided vehicles, working principle, types, traffic control of agv's, role of robots in material handling, automated storage systems, storage system performance, AS/RS-carousel storage system, WIP storage systems, interfacing handling and storage with manufacturing.

UNIT-III	AUTOMATEDMATERIAL HANDLING AND STORAGE PLANNING	Classes: 09

Planning, scheduling and computer control of FMS, hierarchy of computer control, supervisory computer.

DNC system, communication between DNC computer and machine control unit, features of DNC systems.

UNIT-IV	COMPUTER CONTROL OF FMS	Classes: 09

System issues, types of software, inspection and selection, trends, application of simulation and its software, manufacturing data systems, planning FMS data base; Modeling of fms analytical, heuristics, queuing, simulation and petrinets modeling techniques.

UNIT-V	SCHEDULING OF FLEXIBLE MANUFACTURING SYSTEM	Classes: 09

Scheduling of operations on a single machine, two machine flow shop scheduling, two machine job shop scheduling, three machine flow shop scheduling, scheduling 'n' operations on 'n' machines, knowledge based scheduling, scheduling rules, tool management of FMS, material handling system schedule.

Text Books:

1. H. K. Shivanand, M. M. Benal, V. Koti, "Flexible Manufacturing Systems", New Age Publishers, 1st Edition, 2013.
2. Taiichi Ohno, "Toyota Production System Beyond Large scale Production", Productivity Press, 2013.

Reference Books:
1. Nand K. Jha, “Handbook of Flexible Manufacturing Systems”, Academic Press Inc, 1st Edition, 2013. 2. S. Joshi, Jeffery Smith, “Computer Control of Flexible Manufacturing Systems”, Chapman & Hall, 1st Edition, 2013.
Web References:
1. http://www. nptel.ac.in/courses/112103174/ 2. https://www.youtube.com/playlist?list=PL23ED9B2FB7537D1A
E-Text Book:
1. www.electronicsforu.com › Engineering Projects For You › Design Guides 2. www.e-booksdirectory.com › Engineering
Course Home Page:

ELEMENTS OF MECHANICAL ENGINEERING

VI Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AME551	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Familiarize with fundamentals of mechanical systems.
II. Understand and appreciate the significance of mechanical engineering in different fields of engineering.
III. Understanding of application and usage of various engineering materials.

UNIT-I	INTRODUCTION TO ENERGY SYSTEMS	Classes: 09

Introduction: Prime movers and its types, concept of force, pressure, energy, work, power, system, heat, temperature, specific heat capacity, change of state, path, process, cycle, internal energy, enthalpy, statement of zeroth law and first law; Energy: Introduction and application, of energy sources like fossil fuels, nuclear fuels, hydels, solar, wind, and bio-fuels, environment issues like global warming and ozone depletion; Properties of gases: Gas laws, Boyle’s law, Charle’s law, gas constant, relation between C_p and C_v, various non flow processes like constant volume processes, constant pressure process, isothermal process, adiabatic process, poly-tropic process.

UNIT-II	STEAM TURBINES, HYDRAULIC MACHINES	Classes: 09

Properties of steam: Steam formation, types of steam enthalpy, specific volume, internal volume, internal energy and dryness fraction of steam, use of steam tables, calorimeters; Heat engine: Heat engine cycle and heat engine, working substances, classification of heat engines, description and thermal efficiency of carnot, Rankine, otto cycle, diesel cycles; Steam boilers: Introduction, cochran, lancashire, babcock, and Wilcox boiler, functioning of different mountings and accessories.

UNIT-III	INTERNAL COMBSUTION ENGINES, REFRIGERATION AND AIR-CONDITIONING	Classes: 09

Internal combustion engines: Introduction, classification, engine details, four stroke, two stroke cycle, petrol engine, diesel engine, indicated power, brake power, efficiencies; Pumps: Types, operation of reciprocating. rotary, centrifugal pumps, priming.

Air compressors: Types, operation of reciprocating, rotary air compressors, significance of multi-staging; Refrigeration and air-conditioning: Refrigerant, vapor compression refrigeration system, vapor absorption refrigeration system, domestic refrigerator, window and split air conditioners.

UNIT-IV	MACHINE TOOLS AND AUTOMATION	Classes: 09

Machine tools and automation machine tools operation: Turning, facing , knurling, thread cutting, taper turning by swiveling the compound rest, drilling, boring, reaming, tapping, counter sinking, counter boring, plane milling, end milling, slot milling; Robotic and automation: Introduction, classification based on robot configuration, polar, cylindrical, cartesian, coordinate and spherical, application, advantages and advantages; Automation: Definition, types, fixed, programmable and flexible automation, NC/CNC machines, basic elements with simple block diagrams, advantages and disadvantages.

UNIT-V	ENGINEERING MATERIALS, JOINING PROCESS	Classes: 09
Engineering materials and joining processes: Types, applications of ferrous metals, non-ferrous metals, alloys; Composites: Introduction, definition, classification and application (Automobile and Air Craft).		

Text Books:

1. V. K. Manglik, "Elements of Mechanical Engineering", Prentice Hall, 1st Edition, 2013.
2. Mikell P. Groover, "Automation, Production Systems and CIM", Prentice Hall, 4th Edition, 2015.

Reference Books:

1. S. Trymbaka Murthy, "A Text Book of Elements of Mechanical Engineering", University Press, 4th Edition, 2006.
2. K. P. Roy, S. K. Hajra Choudary, Nirjhar Roy, " Element of Mechanical Engineering", Media Promoters & Publishers, 7th Edition, 2012.
3. Pravin Kumar, "Basic Mechanical Engineering", Pearson, 1st Edition, 2013.

Web References:

1. http://www.nptel.ac.in/courses/112107144/
2. *http://www.*nptel.ac.in/courses/112101098/download/lecture-37.pdf

E-Text Books:

1. www.wiley-vch.de/vch/journals/2081/books/2081_rel_title_varadan.pdfM
2. www.ebooks.cawok.pro/Artech.House.Publishers.An.Introduction.to.Microelectrical.pdf

Course Home Page:

DISASTER MANAGEMENT

VI Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACE551	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Identify the major disaster types and develop an understanding of modern disaster management.
II. Recognize and develop awareness of the chronological phases of natural disaster response and refugee relief operations.
III. Understand the key concepts of disaster management related to development and the relationship of different disaster management activities.
IV. Categorize the organizations that are involved in natural disaster assistance and relief system.

UNIT-I	ENVIRONMENTAL HAZARDS AND DISASTERS	Classes: 09

Environmental hazards and disasters: meaning of environmental hazards, environmental disasters and environmental stress; concept of environmental hazards, environmental stress and environmental disasters, different approaches and relation with human ecology, landscape approach, ecosystem approach, perception approach, human ecology and its application in geographical researches.

UNIT-II	TYPES OF ENVIRONMENTAL HAZARDS AND DISASTERS	Classes: 09

Types of environmental hazards and disasters: Natural hazards and disasters, man induced hazards and disasters, natural hazards, planetary hazards/ disasters, extra planetary hazards/ disasters, planetary hazards, endogenous hazards, exogenous hazards.

UNIT-III	ENDOGENOUS HAZARDS	Classes: 09

Endogenous hazards, volcanic eruption, earthquakes, landslides, volcanic hazards/ disasters, causes and distribution of volcanoes, hazardous effects of volcanic eruptions, environmental impacts of volcanic eruptions.

Earthquake hazards/ disasters, causes of earthquakes, distribution of earthquakes, hazardous effects of, earthquakes, earthquake hazards in India, human adjustment, perception and mitigation of earthquake.

UNIT-IV	EXOGENOUS HAZARDS	Classes: 09

Exogenous hazards/ disasters, infrequent events, cumulative atmospheric hazards/ disasters; Infrequent events: Cyclones , lightning , hailstorms; Cyclones: Tropical cyclones and local storms, destruction by tropical cyclones and local storms (causes, distribution human adjustment, perception and mitigation); Cumulative atmospheric hazards/ disasters: Floods, droughts, cold waves, heat waves floods; Causes of floods, flood hazards India, flood control measures (human adjustment, perception and mitigation); Droughts: Impacts of droughts, drought hazards in India, drought control measures, extra planetary hazards/ disasters, man induced hazards /disasters, physical hazards/ disasters, soil erosion, Soil erosion: Mechanics and forms of soil erosion, factors and causes of soil erosion, conservation measures of soil erosion; Chemical hazards/ disasters: Release of toxic chemicals, nuclear explosion, sedimentation processes; Sedimentation processes: Global sedimentation problems regional sedimentation problems, sedimentation and environmental problems, corrective measures of erosion and sedimentation, biological hazards/ disasters, population explosion.

UNIT-V	EMERGING APPROACHES IN DISASTER MANAGEMENT	Classes: 09

Emerging approaches in Disaster Management, Three Stages

1. Pre, disaster stage (preparedness)
2. Emergency Stage
3. Post Disaster stage, Rehabilitation.

Text Books:

1. Pardeep Sahni, “Disaster Mitigation: Experiences and Reflections”, PHI Learning Pvt. Ltd., 1st Edition, 2001.
2. J. Glynn, Gary W. Hein Ke, “Environmental Science and Engineering”, Prentice Hall Publishers, 2nd Edition, 1996.

Reference Books:

1. R.B.Singh (Ed), “Environmental Geography”, 2nd Edition, 1990.
2. R.B. Singh (Ed), “Disaster Management”, 2nd Edition, 2006.

Web References:

1. https://www.google.co.in/?gfe_rd=cr&ei=,iAwWLiDIazv8we8_5LADA#q=disater+mangement
2. http://ndma.gov.in/images/policyplan/dmplan/National%20Disaster%20Management%20Plan%20May%202016.pdf
3. http://www.eib.europa.eu/attachments/pipeline/20080021_eia_en.pdf
4. http://www.ndmindia.nic.in/

E-Text Books:

1. https://www.google.co.in/?gfe_rd=cr&ei=,iAwWLiDIazv8we8_5LADA#q=disaster+management+e+textbooks
2. http://cbse.nic.in/natural%20hazards%20&%20disaster%20management.pdf\
3. http://www.digitalbookindex.org/_search/search010emergencydisastera.asp
4. http://www.icbse.com/books/cbse,ebooks,download

Course Home Page:

GEOSPATIAL TECHNIQUES

VI SEMESTER: Common for all branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACE552	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Apply the technical skills to use geo-referenced data for the purpose of economic, educational, and social development.
II. Apply descriptive and analytical knowledge about map reading, statistics, and geospatial technologies.
III. Integrate the domains of geography and apply their knowledge to issues concerning people, places, and environments.
IV. Describe, analyze, and explain the patterns, processes, and interactions of human and physical phenomena on Earth's surface.

UNIT-I	INTRODUCTION TO GEOSPATIAL DATA	Classes: 09

Introduction geospatial data, why to study geospatial data, importance of geospatial technology, spatial data infrastructure, three important geospatial technologies, spatial elements, coordinates and coordinate systems, basic electromagnetic radiation.

UNIT-II	PHOTOGRAMMETRY AND REMOTE SENSING	Classes: 09

Definition and scope, history of photogrammetry and remote sensing, principle, remote sensing data acquisition, remote sensing data analysis methods, advantages and limitations, hardware and software required; Map vs mosaic, ground control points; Energy interactions with atmosphere and earth surface features.

UNIT-III	MAPPING AND CARTOGRAPHY	Classes: 09

What is map and its importance, map scale and types, elements of map and indexing, map coordinate systems, visual interpretation of satellite images, interpretation of terrain evaluation.

Introduction to digital data analysis, cartographic symbolization, classification of symbols, colours in cartography, scale and purpose of a map, cartographic design, thematic cartography, digital cartography.

UNIT-IV	GEOGRAPHIC INFORMATION SYSTEM	Classes: 09

Introduction to GIS, definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, a theoretical framework for GIS, GIS data structures, data collection and input overview, processing of spatial data, data input or output, vector data model, raster data model, geometric representation of spatial feature and data structure; Spatial data and modeling, tin, DTM, overlay, spatial measurement etc.

UNIT-V	GEOSPATIAL TECHNOLOGIES APPLICATIONS	Classes: 09

Visual image analysis for land use/land cover mapping, land use and land cover in water resources, surface water mapping and inventory, geological and soil mapping, agriculture applications for forestry applications, water resources applications, urban and regional planning, environmental assessment, principles of land form identification and evaluation: sedimentary, igneous and metamorphic rock terrain.

Text Books:

1. John D. Bossler, Taylor, Francis, "Manual of Geospatial Science and Technology", CRC Press, 2010.
2. M. Anji Reddy, "Textbook of Remote Sensing and Geographical Information Systems", BS Publication, 2001.

Reference Books:

1. C. P. Lo Albert, K.W. Yonng, "Concepts and Techniques of GIS", 2nd Edition, 2007.
2. Otto Huisman and Rolf A. de "Principles of Geographic Information Systems", 4th Edition, 2009

Web References:

1. https://www.aaas.org/content/what-are-geospatial-technologies
2. http://www.istl.org/10-spring/internet2.htmls
3. https://geography.columbian.gwu.edu/applied-geospatial-techniques
4. http://kiran.nic.in/pdf/publications/Geospatial_Techniques.pdf

E-Text Books:

1. http://link.springer.com/book/10.1007%2F978-94-007-1858-6
2. http://www.springer.com/us/book/9789400718579
3. http://cbseacademic.in/web_material/doc/2014/7_Geospatial%20Technology%20Text%20Book%20(Class-XII).pdf
4. http://freegeographytools.com/2009/two-free-textbooks-on-geospatialgeostatistical-analysis.

Course Home Page:

PRINCIPLES OF OPERATING SYSTEMS

VI Semester: **Common for all Braches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACS551	**Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand the functionalities of main components in operating systems.
II. Analyze the algorithms used in memory and process management.
III. Understand the clock synchronization protocols.
IV. Interpret the concepts of input and output storage for file management.

UNIT-I	INTRODUCTION	Classes: 10

Operating systems objectives and functions: Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple batch, multi programmed, time shared, real time systems, operating system services; Systems calls: Types of systems calls.

UNIT-II	PROCESS AND CPU SCHEDULING, PROCESS COORDINATION	Classes: 10

Process concepts: The process, process state, process control block, threads; process scheduling: Scheduling queues, schedulers, context switch, preemptive scheduling, dispatcher, scheduling criteria, scheduling algorithms, Process synchronization, the critical section problem; semaphores and monitors.

UNIT-III	MEMORY MANAGEMENT AND VIRTUAL MEMORY	Classes: 08

Logical and physical address space: Swapping, contiguous memory allocation, paging, structure of page table.

Segmentation: Segmentation with paging, virtual memory, demand paging; Page replacement, page replacement algorithms, thrashing.

UNIT-IV	FILE SYSTEM INTERFACE	Classes: 09

The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure, file system implementation, allocation methods, free space management, directory implementation.

UNIT-V	DEADLOCKS, PROTECTION	Classes: 08

System model: Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection, principles of protection, domain of protection, access matrix, implementation of access matrix.

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Principles”, Wiley Student Edition, 8^{th} Edition, 2010.
2. William Stallings, “Operating System- Internals and Design Principles”, Pearson Education, 6^{th} Edition, 2002.

Reference Books:

1. Andrew S Tanenbaum, “Modern Operating Systems”, PHI, 3^{rd} Edition, 2007.
2. D. M. Dhamdhere, “Operating Systems a Concept based Approach”, Tata McGraw Hill, 2^{nd} Edition, 2006.

Web References:

1. https://www.smartzworld.com/notes/operatingsystems
2. https://www.scoopworld.in
3. https://www.sxecw.edu.in
4. https://www.technofest2u.blogspot.com

E-Text Books:

1. https://it325blog.files.wordpress.com/2012/09/operating-system-concepts-7-th-edition.pdf
2. http://mpathinveco.blog.com/2014/11/25/operating-systems-william-stalling-6th-edition/
3. http://www.e-booksdirectory.com/details.php?ebook=10050
4. http://www.e-booksdirectory.com/details.php?ebook=9907
5. http://www.e-booksdirectory.com/details.php?ebook=9460

Course Home Page:

JAVA PROGRAMMING

VI Semester: Common for all Branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACS552	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand fundamentals of object-oriented terminology and programming concepts in java.
II. Acquire basics of how to translate solution problem into object oriented form.
III. Develop programs in java for solving simple applications.
IV. Design and implement simple program that use exceptions and multithreads.

UNIT-I	OOP CONCEPTS AND JAVA PROGRAMMING	Classes: 08

OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, constructors, methods, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow statements, arrays, parameter passing.

UNIT-II	INHERITANCE	Classes: 10

Inheritance: Inheritance hierarchies, super and subclasses, member access rules, Polymorphism**:** Dynamic binding, method overriding, abstract classes and methods.

UNIT-III	EXCEPTION HANDLING AND MULTI THREADING	Classes: 08

Exception Handling: Benefits of exception handling, the classification of exceptions, usage of try, catch, throw, throws and finally.

Multithreading: Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads.

UNIT-IV	INTERFACES AND PACKAGES	Classes: 09

Interface: Interfaces vs Abstract classes, defining an interface, implement interfaces, Packages: Defining, creating and accessing a package, importing packages.

UNIT-V	FILES, AND CONNECTING TO DATABASE	Classes: 10

Files: streams – byte streams, character stream, text input/output, binary input/output, file management; Connecting to Database: Connecting to a database, querying a database and processing the results, updating data with JDBC.

Text Books:

1. Herbert Schildt, Dale Skrien, “Java Fundamentals – A Comprehensive Introduction”, McGraw-Hill, 1st Edition, 2013.
2. Herbert Schildt, “Java the Complete Reference”, McGraw Hill, Osborne, 8thEditon, 2011.
3. T. Budd, “Understanding Object-Oriented Programming with Java”, Pearson Education, Updated Edition (New Java 2 Coverage), 1999.

Reference Books:

1. P. J. Deitel, H. M. Deitel, "Java: How to Program", Prentice Hall, 6^{th} Edition, 2005.
2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, CRC Press, 2007.
3. Bruce Eckel, "Thinking in Java", Prentice Hall, 4^{th} Edition, 2006.
4. Sachin Malhotra, Saurabh Chaudhary, "Programming in Java", Oxford University Press, 2^{nd} Edition, 2014.

Web References:

1. http://www.javatpoint.com/java-tutorial
2. http://www.javatutorialpoint.com/introduction-to-java/

E-Text Books:

1.http://bookboon.com/en/java-programming-language-ebooks
2.https://en.wikibooks.org/wiki/Java_Programming

Course Home Page:

EMBEDDED SYSTEM DESIGN

<table>
<tr><td colspan="9">VI SEMESTER: Common for all Branches</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">AEC551</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: 0</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

OBJECTIVES:

The course should enable the students to:

I. Imbibe knowledge about the basic functions, structure, concepts and applications of Embedded Systems.
II. Understand Real time operating system concepts.
III. Analyze different tools for development of embedded software.
IV. Understand the architecture of advanced processors.

UNIT-I	EMBEDDED COMPUTING	Classes: 09

Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, complex systems and microprocessor, classification, major application areas, the embedded system design process, , formalisms for system design, design examples

UNIT-II	THE 8051 ARCHITECTURE	Classes: 09

Introduction, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/output, Interrupts. The Assembly Language Programming Process, Instructions of 8051 Programming Tools and Techniques, Simple Programs.

UNIT-III	INTRODUCTION TO EMBEDDED C AND APPLICATIONS	Classes: 09

Embedded systems programming in C, binding and running embedded C program in Keil IDE, dissecting the program, building the hardware;

Basic techniques for reading and writing from I/O port pins, LED interfacing, interfacing with keyboards, displays, D/A and A/D conversions, using embedded C interfacing

UNIT-IV	INTRODUCTION TO REAL – TIME OPERATING SYSTEMS	Classes: 09

Tasks and Task States, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Interrupt Routines in an RTOS Environment. Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine

UNIT-V	INTRODUCTION TO ADVANCED ARCHITECTURES	Classes: 09

ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus.

Text Books:

1. Wayne Wolf, “Principles of Embedded Computing System Design”, Elseveir., 2nd Edition 2014,
2. Kenneth J.Ayala, “The 8051 Microcontroller”, Thomson, 3rd Edition 2016,.
3. Dr. K V K K Prasad, “Embedded / Real-Time Systems : Concepts, Design And Programming”, Black Book , DreamTech Press, ISBN: 9788177224610

Reference Books:

1. Embedding system building blocks, Labrosse, via CMP publishers.
2. Embedded Systems, Raj Kamal, TMH.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley
5. Microcontrollers, Raj kamal, Pearson Education.
6. An Embedded Software Primer, David E. Simon, Pearson Education.
7. 8051 Microcontroller and Embedded Systems, by Muhammad Ali Mazadi,Janice Mazidi,Janice Gillispie Mazdi

Web References:

1. https://www.smartzworld.com/notes/embedded-systems-es/
2. http://notes.specworld.in/embedded-systems-es/
3. http://education.uandistar.net/jntu-study-materials
4. http://www.nptelvideos.in/2012/11/embedded-systems.html

E-Text Books:

1. https://www.scribd.com/doc/233633895/Intro-to-Embedded-Systems-by-Shibu-Kv
2. http://www.ee.eng.cmu.ac.th/~demo/think/_DXJSq9r3TvL.pdf
3. https://www.scribd.com/doc/55232437/Embedded-Systems-Raj-Kamal
4. https://docs.google.com/file/d/0B6Cytl4eS_ahUS1LTkVXb1hxa00/edit
5. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf

INTRODUCTION TO AUTOMOBILE ENGINEERING

VI Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME552	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

VI. Understand the function of various parts of automobile, features of fuel supply systems for S.I and C.I engines.

VII. Distinguish the features of various types of cooling, ignition and electrical systems.

VIII. Identify the merits and demerits of the various transmission and suspension systems.

IX. Recognize the working of various braking and steering systems.

X. Summarize the ways and means of reducing the emissions from automobiles.

UNIT-I	INTRODUCTION	Classes: 09

Introduction to automobile engineering, chassis and automobile components, automobile engines, otto cycle, diesel cycle, dual cycle, engine lubrication, lubricating oil, lubrication oil filter, engine servicing; Fuel supply system; Fuel tank, strainer, feed pump, fuel filter, injection pump, injector, filters, electronic controlled fuel injection, common rail direct injection systems.

UNIT-II	COOLING SYSTEM	Classes: 09

Cooling requirements, air cooling, liquid cooling, water forced circulation system, radiators, cooling fan, water pump, thermostat, pressure sealed cooling, antifreeze solutions, intelligent cooling; Ignition system: Function of an ignition system, battery ignition system, storage battery, condenser and spark plug, magneto coil ignition system, electronic ignition system, electronic ignition, spark advance mechanisms; Electrical system: Charging circuit, generator, current-voltage regulator, starting system, bendix drive mechanism solenoid switch, lighting systems, automatic high beam control, horn, wiper, fuel gauge, oil pressure gauge, engine temperature indicator.

UNIT-III	TRANSMISSION AND SUSPENSIONS SYSTEMS	Classes: 09

Transmission system: Clutches, principle, types, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel.

Gear boxes, types, constant mesh, synchro mesh gear boxes, epicyclic gear box, auto transmission, continuous variable transmission, propeller shaft, Hotch-Kiss drive, Torque tube drive, universal joint, differential, rear axles types, wheels and tyres; Suspension system: Objects of suspension systems, rigid axle suspension system, torsion bar, shock absorber, independent suspension system.

UNIT-IV	BRAKING AND STEERING SYSTEMS	Classes: 09

Braking system: Mechanical brake system, Hydraulic brakes system, Master cylinder, wheel cylinder, Requirements of brake fluid, pneumatic and vacuum brake, ABS; Steering system: Steering geometry, camber, castor, king pin, rake, combined angle toe-in, toe-out, types of steering mechanism, Ackerman steering mechanism, Davis steering mechanism, steering gears types, steering linkages.

UNIT-V	EMISSIONS FROM AUTOMOBILES	Classes: 09

Emissions from automobiles, pollution standards national and international, pollution control techniques, petrol injection, common rail diesel injection, variable valve timing; Energy alternatives, solar, photo-voltaic, hydrogen, biomass, alcohols, LPG, CNG, liquid fuels and gaseous fuels, hydrogen as a fuel for internal combustion engines, their merits and demerits.

Text Books:

4. Willam H crouse, Donald L. Anglin, “Automobile Engineering”, McGraw Hill, 10^{th} Edition, 2006.
5. Manzoor, Nawazish Mehdi, Yosuf Ali, “A Text Book Automobile Engineering”, Frontline Publications, 1^{st} Edition, 2011.

Reference Books:

1. R. K. Rajput, “A Text Book of Automobile Engineering”, Laxmi Publications, 1^{st} Edition, 2015.
2. Joseph Heinter, “Automotive Mechanics”, CBS, 2^{nd} Edition, 2006.
3. K. Netwon, W. Steeds, T. K.Garrett, “Automotive Engineering”, Butterworth-Heinamann, 13^{th} Edition, 2016.
4. S. Srinivasan, “Automotive Engines”, Tata McGraw-Hill, 2^{nd} Edition, 2003.
5. Khalil. U. Siddiqui, “A Text Book of Automobile Engineering”, New Age International, 1^{st} Edition, 2012.

Web References:

1. http://www.nptel.kmeacollege.ac.in/syllabus/125106002/
2. http://www.nptel.ac.in/courses/125106002/

E-Text Books:

1. http:// www.engineeringstudymaterial.net/tag/automotive-engineering-books
2. https://www.studynama.com/.../299-Automobile-engineering-lecture-notes-ebook-pdf

Course Home Page:

INTRODUCTION TO ROBOTICS

VI Semester: **Common for all Branches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME553	Elective	3	-	-	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Familiarize with the automation and brief history of robot and applications.
II. Understand the kinematics of robots and knowledge about robot end effectors and their design.
III. Apply robot actuators and feedback components to automation.

UNIT-I	INTRODUCTION TO ROBOTICS	Classes: 09

Introduction: Automation and robotic, an over view of robotics, classification by coordinate system and control systems; Components of the industrial robotics: Degrees of freedom, end effectors: Mechanical gripper, magnetic, vacuum cup and other types of grippers, general consideration on gripper selection and design.

UNIT-II	MOTION ANALYSIS AND KINEMATICS	Classes: 09

Motion analysis: Basic rotation matrices, composite rotation matrices, Euler angles, equivalent angle and axis, homogeneous transformation, problems; Manipulator kinematics: D-H notations, joint coordinates and world coordinates, forward and inverse kinematics, problems.

UNIT-III	KINEMATICS AND DYNAMICS	Classes: 09

Differential kinematics: Differential kinematics of planar and spherical manipulators, Jacobians, problems.

Robot dynamics: Lagrange, Euler formulations, Newton-Euler formulations, problems on planar two link manipulators.

UNIT-IV	TRAJECTORY PLANNING AND ACTUATORS	Classes: 09

Trajectory planning: Joint space scheme, cubic polynomial fit, avoidance of obstacles, types of motion: Slew motion, joint interpolated motion, straight line motion, problems; Robot actuators and feedback components; Actuators: pneumatic and hydraulic actuators.

UNIT-V	ELECTRIC ACTUATORS AND ROBOTIC APPLICATIONS	Classes: 09

Electric actuators: DC servo motors, stepper motors, feedback components: position sensors, potentiometers, resolvers and encoders, velocity sensors, tactile sensors; Robot application in manufacturing: Material handling, assembly and inspection.

Text Books:

1. Groover M. P, “Industrial Robotics”, Tata McGraw-Hill, 1st Edition, 2013.
2. J. J Craig,” Introduction to Robotic Mechanics and Control”, Pearson, 3rd Edition, 2013.

Reference Books:

1. Richard D. Klafter, “Robotic Engineering”, Prentice Hall, 1st Edition, 2013.
2. Fu K S, “Robotics”, McGraw-Hill, 1st Edition, 2013.

Web References:

1. https://www.doc.ic.ac.uk/~ajd/Robotics/RoboticsResources/lecture1.pdf
2. http://opencourses.emu.edu.tr/course/view.php?id=32
3. https://www.researchgate.net/publication/277712686_Introduction_to_Robotics_class_notes_UG_level

E-Text Books:

1. http://*www.robot.bmstu.ru/*
2. http://www.robotee.com/index.php/download-free-robotic-e-books/

Course Home Page:

AEROSPACE PROPULSION AND COMBUSTION

VI Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AAE551	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Demonstrate with an overview of various aerospace propulsion systems and a sound foundation in the fundamentals of thermodynamics.

II. Distinguish the elementary principles of thermodynamic cycles as applied to propulsion analysis.

III. Prioritize an introduction to combustion& gas kinetic theory.

IV. Discover a working knowledge of and the tools to measure various flight propulsion systems such as turbojets, turbofans, ramjets, rockets, air turbo-rockets and nuclear/electric propulsion systems.

UNIT-I	ELEMENTS OF AIRCRAFT PROPULSION	Classes: 10

Classification of power plants, methods of aircraft propulsion, propulsive efficiency, specific fuel consumption, thrust and power, factors affecting thrust and power, illustration of working of gas turbine engine, characteristics of turboprop, turbofan and turbojet, ram jet, scram jet, methods of thrust augmentation, atmospheric properties, turbojet, turbofan, turboprop, turbo-shaft engine construction and nomenclature, theory and performance, introduction to compressors, turbines, combustors and after burners for aircraft engines.

UNIT-II	PROPELLER THEORY	Classes: 08

Momentum theory, Blade element theory, combined blade element and momentum theory, propeller power losses, propeller performance parameters, prediction of static thrust and in flight, negative thrust, prop fans, ducted propellers, propeller noise, propeller selection, propeller charts.

UNIT-III	INLETS, NOZZLES AND COMBUSTION CHAMBERS	Classes: 10

Subsonic and supersonic inlets, relation between minimum area ratio and external deceleration ratio, starting problem in supersonic inlets, modes of inlet operation, jet nozzle, efficiencies, over expanded, under and optimum expansion in nozzles, thrust reversal.

Classification of combustion chambers, combustion chamber performance flame tube cooling, flame stabilization.

UNIT-IV	THERMODYNAMICS OF REACTING SYSTEMS	Classes: 09

Chemical kinetics: equilibrium, analysis of simple reactions, steady, state and partial equilibrium approximations, explosion theories; Transport phenomena: Molecular and convective transports; Conservation equations of multicomponent, reacting systems.

UNIT-V	PREMIXED FLAMES	Classes: 08

Rankine hugoniot relations, theories of laminar premixed flame propagation, quenching and flammability limits; Diffusion flames: Burke-Schumann theory, laminar jet diffusion flame, droplet combustion, turbulent combustion, closure problem, premixed and non-premixed turbulent combustion, introduction to DNS and LES.

Text Books:
1. Stephen R. Turns, "An Introduction to Combustion", McGraw-Hill, 3rd Edition, 2012. 2. Thomas A. Ward, "Aerospace Propulsion Systems", John Wiley and Sons, 1st Edition, 2010.
Reference Books:
1. M. H. Sadd, "Elasticity: Theory, Applications, and Numerics", Academic Press, 2nd Edition, 2009. 2. R. G. Budynas, "Advanced Strength and Applied Stress Analysis", McGraw-Hill, 2nd Edition, 1999. 3. A. P. Boresi, R.J. Schmidt, "Advanced Mechanics of Materials", John Willey & Sons, 5th Edition, 2003.
Web References:
1. https://www.nptel.ac.in/courses/101101002/ 2. https://www.en.wikipedia.org/wiki/Airbreathing_jet_engine 3. https://www.en.wikipedia.org/wiki/Combustor 4. https://www.aero.iisc.ernet.in/page/propulsion
E-Text Books:
1. https://www.as.wiley.com/WileyCDA/WileyTitle/productCd-1118307984.html 2. https://www.sciencedirect.com/science/book/9781856179126 3. https://www.books.google.co.in/books?id=iUuPAQAAQBAJ&source=gbs_similarbooks
Course Home Page:

FUNDAMENTALS OF IMAGE PROCESSING

VII SEMESTER: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC552	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 0	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the image fundamentals and the relationship between pixels.
II. Understand the image enhancement techniques in spatial domain and frequency domain.
III. Analyze the image restoration technique from degraded image using various filtering techniques.
IV. Design segmentation of the image for boundary detection.
V. Differentiate redundancy techniques and apply for image compression.

UNIT-I	INTRODUCTION	Classes: 09

Digital image fundamentals and image transforms digital image fundamentals, sampling and quantization, relationship between pixels.

UNIT-II	IMAGE ENHANCEMENT	Classes: 09

Introduction, image enhancement in spatial domain, enhancement through point processing, types of point processing, histogram manipulation, linear and non-linear gray level transformation, local or neighborhood operation, median filter processing; Spatial domain high pass filtering, filtering in frequency domain, obtaining frequency domain filters from spatial filters, generating filters directly in the frequency domain, low pass (smoothing) and high pass (sharpening) filters in frequency domain

UNIT-III	IMAGE RESTORATION	Classes: 9

Image restoration degradation model, algebraic approach to restoration, inverse filtering.

Least mean square filters, constrained least square restoration, interactive restoration.

UNIT-IV	IMAGE SEGMENTATION, MORPHOLOGICAL IMAGE PROCESSING	Classes: 9

Image segmentation detection of discontinuities, edge linking and boundary detection, threshold, region oriented segmentation. Morphological image processing dilation and erosion, structuring element decomposition, the Strel function, erosion; Combining dilation and erosion: Opening and closing the hit and miss transformation.

UNIT-V	IMAGE COMPRESSION	Classes: 09

Image compression: Redundancies and their removal methods, fidelity criteria, image compression models, source encoder and decoder, error free compression, lossy compression, JPEG 2000 standard.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing‖, Pearson”, 3rd Edition, 2008.
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, “Digital Image Processing”, TMH, 3rd Edition, 2010.

Reference Books:

1. Rafael, C. Gonzalez, Richard E woods, Stens L Eddings, “Digital Image Processing using MATLAB”, Tata McGraw Hill, 2nd Edition, 2010.
2. A.K. Jain, “Fundamentals of Digital Image Processing”, PHI, 1st Edition, 1989.
3. Somka, Hlavac, Boyle, “Digital Image Processing and Computer Vision”, Cengage Learning, 1st Edition, 2008.
4. Adrain Low, “Introductory Computer vision Imaging Techniques and Solutions”, Tata McGraw-Hill, 2nd Edition, 2008.
5. John C. Russ, J. Christian Russ, “Introduction to Image Processing & Analysis”, CRC Press, 1st Edition, 2010.

Web References:

1. https://imagingbook.com/
2. https://en.wikipedia.org/wiki/Digital_image_processing
3. http://www.tutorialspoint.com/dip/
4. http://www.imageprocessingplace.com/
5. http://web.stanford.edu/class/ee368/
6. https://sisu.ut.ee/dev/imageprocessing/book/1
7. https://in.mathworks.com/discovery/digital-image-
8. processing.html?requestedDomain=www.mathworks.com

E-Text Books:

1. http://www.sci.utah.edu/~gerig/CS6640-F2010/dip3e_chapter_02.pdf
2. http://www.faadooengineers.com/threads/350-Digital-Image-Processing
3. http://newwayofengineering.blogspot.in/2013/08/anil-k-jain-fundamentals-of-digital.html
4. http://bookboon.com/en/digital-image-processing-part-one-ebook

FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS

VII Semester: Common for all Branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACS553	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the role of database management system in an organization and learn the database concepts.
II. Design databases using data modeling and data normalization techniques.
III. Construct database queries using relational algebra and calculus.
IV. Understand the concept of a database transaction and related database facilities.
V. Learn how to evaluate set of queries in query processing.

UNIT-I	CONCEPTUAL MODELING	Classes: 10

Introduction to file and database systems: Database system structure, data models: entity relationship model, relational model.

UNIT-II	RELATIONAL APPROACH	Classes: 08

Relational algebra and calculus: Relational algebra, selection and projection, set operations, renaming, joins, division, examples of algebra queries, relational calculus, tuple relational calculus.

UNIT-III	BASIC SQL QUERY AND NORMALIZATION	Classes: 10

SQL data definition; Queries in SQL: updates, views, integrity and security, relational database design.

Normal Forms: 1NF, 2NF, 3NF and BCNF.

UNIT-IV	TRANSACTION MANAGEMENT	Classes: 09

Transaction processing: Introduction, need for concurrency control, desirable properties of transaction, schedule and recoverability, Serializability and schedules.

UNIT-V	CONCURRENCY CONTROL	Classes: 08

Concurrency control; Types of locks: Two phases locking, deadlock, timestamp based concurrency control, recovery techniques, concepts, immediate update, deferred update, shadow paging.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 4th Edition, 2002.

Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 3rd Edition, 2003.
2. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2003.
3. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States, 1st Edition, 2000.
4. Peter Rob, Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003.

Web References:

1. https://www.youtube.com/results?search_query=DBMS+onluine+classes
2. http://www.w3schools.in/dbms/
3. http://beginnersbook.com/2015/04/dbms-tutorial/

E -Text Books:

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re

Course Home Page:

BASICS OF INFORMATION SECURITY AND CRYPTOGRAPHY

VII Semester: **Common for all Branches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AIT551	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Learn the basic categories of threats to computers and networks.
II. Understand various cryptographic algorithms and be familiar with public-key cryptography.
III. Apply authentication functions for providing effective security.
IV. Analyze the application protocols to provide web security.
V. Discuss the place of ethics in the Information Security Area.

UNIT-I	ATTACKS ON COMPUTERS	Classes: 08

Attacks on computers and computer security: Introduction, the need for security, security approaches, types of security attacks and security services. \

UNIT-II	SYMMETRIC KEY CIPHERS	Classes: 10

Symmetric key ciphers: Block cipher principles and algorithms (DES, AES), differential and linear cryptanalysis, block cipher modes of operation, stream ciphers; Asymmetric key ciphers: Principles of public key cryptosystems, algorithms (RSA Diffie – Helman).

UNIT-III	MESSAGE AUTHENTICATION AND CRYPTOGRAPHY	Classes: 08

Message authentication algorithm and hash functions: Authentication requirements, functions, message, authentication codes, hash functions, secure hash algorithm, whirlpool, digital signatures.

Cryptography: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography.

UNIT-IV	E-MAIL SECURITY	Classes: 10

E-mail security: Pretty good privacy; S/MIMI IP Security: IP security overview, IP security architecture, authentication header, encapsulating security payload, combining security associations, key management.

UNIT-V	WEB SECURITY	Classes: 09

Web security: Web security considerations, secure electronic transaction intruders; Virus and firewalls: Intruders, intrusion detection password management, virus and related threats, firewall design principles; Types of firewalls.

Text Books:

1. William Stallings, "Cryptography and Network Security", Pearson Education, 4th Edition, 2005.
2. AtulKahate, "Cryptography and Network Security", McGraw-Hill, 2nd Edition, 2009.

Reference Books:

1. C K Shymala, N Harini, Dr. T R Padmanabhan, "Cryptography and Network Security", Wiley India, 1st Edition, 2016.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay , "Cryptography and Network Security", McGraw-Hill, 2nd Edition, 2010.

Web References:

1. http://bookboon.com/en/search?q=INFORMATION+SECURITY
2. https://books.google.co.in/books/about/Cryptography_Network_Security_Sie_2E.html?id=Kokjwdf0E7QC
3. https://books.google.co.in/books/about/Information_Security.html?id=Bh45pU0_E_4C

E-Text Books:

1. https://books.google.co.in/books/about/Information_Security.html
2. http://www.amazon.in/Cryptography-Network-Security-Behrouz-Forouzan/dp/007070208X

Course Home Page:

MODELING AND SIMULATION

VII Semester: Common to All Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS551	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic system concept and definitions of system.
II. Study the techniques to model and to simulate various systems.
III. Analyze a system and to make use of the information to improve the performance.

UNIT-I	INTRODUCTION	Classes: 08

When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of models; Discrete event system simulation; Steps in a simulation study; The basics of spreadsheet simulation; Simulation example: Simulation of queuing systems in a spreadsheet.

UNIT-II	GENERAL PRINCIPLES SIMULATION SOFTWARE	Classes: 10

Concepts in discrete-event simulation: The event-scheduling / time-advance algorithm, world views, manual simulation using event scheduling; List processing, simulation in java; Simulation in GPSS review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

UNIT-III	QUEUING MODELS AND RANDOM NUMBERS	Classes: 08

Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues; Rough-cut modeling: An illustration.

Properties of random numbers: Generation of pseudo random numbers; Techniques for generating random numbers; Tests for random numbers random-variate generation: Inverse transforms technique; Acceptance-rejection technique; Special properties.

UNIT-IV	INPUT MODELING	Classes: 10

Data collection; Identifying the distribution with data; Parameter estimation; Goodness of fit tests; Fitting a non-stationary poisson process; Selecting input models without data; Multivariate and time-series input models.

UNIT-V	ESTIMATION OF ABSOLUTE PERFORMANCE	Classes: 09

Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations; Model building, verification and validation; Verification of simulation models; Calibration and validation of models, optimization via simulation.

Text Books:

Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, “Discrete-Event System Simulation”, Pearson Education, 5th Edition, 2010.
Reference Books:
1. Lawrence M. Leemis, Stephen K. Park, “Discrete – Event Simulation: A First Course”, Pearson Education, 1st Edition, 2006. 2. Averill M., “Law: Simulation Modeling and Analysis”, Tata McGraw-Hill, 4th Edition, 2007.
Web References:
1. https://storage.googleapis.com/northwestern14-edu/Vtu-Notes-For-System-Modeling-And Simulation.pd. 2. http://www.slideshare.net/qwerty626/system-simulation-modeling-notessjbit.
E-Text Books:
1. http://www.e-booksdirectory.com/listing.php?category=100 2. https://www.google.co.in/?gfe_rd=cr&ei=YGRCWOWMKuPx8AfQqaaoCg#q=simulation+and+modeling+e+books&start=30
Course Home Page:

RESEARCH METHODOLOGIES

VII Semester: Common for All Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS552	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Orient the student to make an informed choice from the large number of alternative methods and experimental designs available.

II. Empower the student with the knowledge and skills they need to undertake a research project, to present a conference paper and to write a scientific article.

III. Develop a thorough understanding of the fundamental theoretical ideas and logic of research.

IV. Identify various sources of information for literature review and data collection.

UNIT-I	INTRODUCION TO RESEARCH AND PHILOSOPHIES	Classes: 07

Introduction to research: The role of research, research process overview; Philosophies and the language of research theory building: Science and its functions, what is theory, the meaning of methodology.

UNIT-II	A RESEARCHER PROBLEMS AND HYPOTHESES	Classes: 10

Thinking like a researcher: Understanding concepts, constructs, variables, and definitions; Problems and hypotheses: Defining the research problem, formulation of the research hypotheses, the importance of problems and hypotheses.

UNIT-III	RESEARCH DESIGN AND DATA COLLECTION	Classes: 09

Research design: Experimental and no experimental research design, field research, and survey research.

Methods of data collection: Secondary data collection methods, qualitative methods of data collection, and survey methods of data collection.

UNIT-IV	ATTITUDE MEASUREMENT , SCALING AND SAMPLING TECHNIQUES	Classes: 09

Attitude measurement and scaling: Types of measurement scales; Questionnaire designing, reliability and validity; Sampling techniques: The nature of sampling, probability sampling design, non probability sampling design, and determination of sample size.

UNIT-V	PROCESSING AND ANALYSIS OF DATA,ETHICAL ISSUES	Classes: 10

Processing and analysis of data ; Ethical issues in conducting research; Report generation, report writing, and APA format; Title page, abstract, introduction, methodology, results, discussion, references, and appendices.

Text Books:

1. Bryman, Alan, Bell, Emma, "Business Research Methods", Oxford University Press, 3rd Edition, 2011.
2. Kerlinger, F.N., Lee, H.B.,"Foundations of Behavioral Research", Harcourt Inc., 4th Edition, 2000.
3. Rubin, Allen, Babbie, Earl, "Essential Research Methods for Social Work", Cengage Learning Inc., USA, 2009.

Reference Books:

1. Anantasi A., Urbina S., “Psychological Testing”, Pearson Education, 2004.
2. Chawla, Deepak, Sondhi, Neena, “Research Methodology: Concepts and Cases”, Vikas Publishing House Pvt. Ltd. Delhi, 2011.
3. Pawar B. S., “Theory Building For Hypothesis Specification In Organizational Studies”, Response Books, New Delhi, 2009.
4. NeumanW.L., “Social Research Methods: Qualitative and Quantitative Approaches”, Pearson Education, 2008.

Web References:

1. https://en.wikipedia.org/wiki/Online_research_methods
2. https://www.prescott.edu/library/resources/research-bibliography.php

E-Text Books:

1. https://www.hcmuaf.edu.vn/.../Research%20Methodology%20-%20Methods%20and%20T...
2. https://www.federaljack.com/ebooks/My%20collection%20of%20medical%20books,%2020...

Course Home Page:

ENERGY FROM WASTE

VII Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE551	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the principles associated with effective energy management and to apply these principles in the day to day life.
II. Develop insight into the collection, transfer and transport of municipal solid waste.
III. Explain the design and operation of a municipal solid waste landfill.
IV. Device key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities.

UNIT - I	INTRODUCTION TO WASTE AND WASTE PROCESSING	Classes: 08

Solid waste sources solid waste sources, types, composition, properties, global warming; Municipal solid waste: Physical, chemical and biological properties, waste collection and, transfer stations, waste minimization and recycling of municipal waste, segregation of waste, size reduction, managing waste, status of technologies for generation of energy from waste treatment and disposal aerobic composting, incineration, furnace type and design, medical waste / pharmaceutical waste treatment technologies, incineration, environmental impacts, measures to mitigate environmental effects due to incineration .

UNIT - II	WASTE TREATMENT AND DISPOSAL	Classes: 10

Land fill method of solid waste disposal land fill classification, types, methods and sitting consideration; Layout and preliminary design of landfills: Composition, characteristics, generation, movement and control of landfill leach ate and gases, environmental monitoring system for land fill gases.

UNIT - III	BIO-CHEMICAL CONVERSION	Classes: 09

Energy generation from waste bio-chemical conversion: Sources of energy generation, anaerobic digestion of sewage and municipal waste, direct combustion of MSW-refuse derived solid fuel.

Industrial waste, agro residues and anaerobic digestion.

UNIT - IV	THERMO-CHEMICAL CONVERSION	Classes: 10

Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion.

UNIT - V	E-WASTE MANAGEMENT	Classes: 08

E-waste: E-waste in the global context: Growth of electrical and electronics industry in India, environmental concerns and health hazards; Recycling e-waste: A thriving economy of the unorganized sector, global trade in hazardous waste, impact of hazardous e-waste in India; Management of e-waste: E-waste legislation, government regulations on e-waste management, international experience, need for stringent health safeguards and environmental protection laws of India.

Text Books:

1. Nicholas P Cheremisinoff, "Handbook of Solid Waste Management and Waste Minimization Technologies", An Imprint of Elsevier, New Delhi, 2003.
2. P Aarne Vesilind, William A Worrell and Debra R Reinhart, "Solid Waste Engineering", 2nd edition 2002.
3. M Dutta , B P Parida, B K Guha and T R Surkrishnan, "Industrial Solid Waste Management and Landfilling practice", Reprint Edition New Delhi, 1999.
4. Rajya Sabha Secretariat, "E-waste in India: Research unit", Reprint Edition, June, 2011.
5. Amalendu Bagchi Design, "Construction and Monitoring of Landfills", John Wiley and Sons, New York, 1994.
6. M. L. Davis and D. A. Cornwell, "Introduction to environmental engineering", International Edition, 2008.
7. C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Ltd. New Delhi, 1995.
8. S. K. Agarwal, "Industrial Environment Assessment and Strategy", APH Publishing Corporation, New Delhi, 1996.
9. Sofer, Samir S. (ed.), Zaborsky, R. (ed.), "Biomass Conversion Processes for Energy and Fuels", New York, Plenum Press, 1981.
10. Hagerty, D.Joseph; Pavoni, Joseph L; Heer, John E., "Solid Waste Management", New York, Van Nostrand, 1973.
11. George Tchobanoglous, Hilary Theisen and Samuel Vigil Prsl: Tchobanoglous, George Theisen, Hillary Vigil, Samuel, "Integrated Solid Waste management: Engineering Principles and Management issues", New York, McGraw Hill, 1993.

Reference Books:

1. C Parker and T Roberts (Ed), "Energy from Waste", An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
2. KL Shah, "Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, Reprint Edition, 2000.
3. M Datta, "Waste Disposal in Engineered Landfills", Narosa Publishing House, 1997.
4. G Rich et.al, Hazardous, "Waste Management Technology", Podvan Publishers, 1987.
5. AD Bhide, BB Sundaresan, "Solid Waste Management in Developing Countries", INSDOC, New Delhi, 1983.

Web References:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, Ramzy Kahnat, Eric williams Tech. & Engg.-2013 (Publisher: Earthscan 2013
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: Sairudeen Pattazhy

E-Text Books:

1. https://www.unep.org
2. https://www.outledge.com
3. https://www.bookdepository.com
4. https://www.ecoactiv.com

Course Home Page:

FINITE ELEMENT ANALYSIS

VII Semester: Common for all branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAE552	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Possess a good understanding of the theoretical basis of the weighted residual finite element method.
II. Use the commercial finite element package ANSYS to build finite element models and solve a selected range of engineering problems.
III. Communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained.

UNIT-I	INTRODUCTION	Classes: 10

Review of various approximate method, variational approach and weighted residual approach application to structural mechanics problems; Finite difference methods- governing equation and convergence criteria of finite element method.

UNIT-II	DISCRETE ELEMENTS	Classes: 10

Bar elements, uniform section, mechanical and thermal loading, varying section, 2D and 3D truss element. Beam element, problems for various loadings and boundary conditions 2D and 3D Frame elements, longitudinal and lateral vibration; Use of local and natural coordinates.

UNIT-III	CONTINUUM ELEMENTS	Classes: 09

Plane stress, plane strain and axi-symmetric problem; Derivation of element matrices for constant.

Linear strain triangular elements and axi-symmetric element.

UNIT-IV	ISOPARAMETRIC ELEMENTS	Classes: 08

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, stiffness matrix and consistent load vector, evaluation of element matrices using numerical integration.

UNIT-V	FIELD PROBLEM AND METHODS OF SOLUTIONS	Classes: 08

Heat transfer problems, steady state fin problems, derivation of element matrices for two dimensional problems, torsion problems. Bandwidth, elimination method and method of factorization for solving simultaneous algebraic equations, features of software packages, sources of error.

Text Books:

1. Tirupathi. R. Chandrapatha, Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Printice Hall India, 3rd Edition, 2003.
2. Rao. S.S., "Finite Element Methods in Engineering", Butterworth and Heinemann, 5th Edition 2010.
3. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill, 3rd Edition, 2005.

Reference Books:

1. Krishnamoorthy C.S, "Finite Element Analysis", Tata McGraw Hill, 2nd Edition 2001.
2. K. J. Bathe, E. L. Wilson, "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
3. Robert D Cook, David S Malkus, Michael E Plesha, "Concepts and Applications of Finite Element Analysis", John Wiley and Sons, Inc., 4th Edition, 2003.
4. Larry J Segerlind, "Applied Finite Element Analysis", John Wiley and Sons, Inc, 2nd Edition, 1984.

Web References:

1. http://home.iitk.ac.in/~sbasu/me623_2006/fem_notes_me623.pdf
2. http://nptel.ac.in/courses/112104116/
3. http://www.me.berkeley.edu/~lwlin/me128/FEMNotes.pdf

E-Text Books:

1. http://www.civilenggforall.com/2015/09/finite-element-analysis-by-ss-bhavikatti-free-download-pdf-civilenggforall.com.html
2. https://books.google.co.in/books/about/Finite_Element_Analysis_For_Engineering.html?id=3XJoK4x5fZwC

Course Home Page:

BASIC REFRIGERATION AND AIR-CONDITIONING

VI Semester: **Common for all Branches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME554	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Analyze and understand various concepts and laws of thermodynamics.
II. Understand the concepts of refrigeration and air refrigeration.
III. Understand vapour compression refrigeration system and also vapour absorption refrigeration system.
IV. Identify various psychometric properties and processes.

UNIT-I	RECAPITULATION OF THERMODYNAMICS	Classes : 09

Recapitulation of thermodynamics: Thermodynamic systems, laws of thermodynamics, phase, state, process, cycle, concepts of enthalpy, entropy, specific heat, sensible heat, latent heat, dryness fraction, correlations involving enthalpy, entropy and dryness fraction, types of various processes and their representation on T-s, P-V and P-h diagrams, carnot cycle, reversed carnot cycle.

UNIT-II	INTRODUCTION AND AIR REFRIGERATION	Classes : 09

Introduction to Refrigeration: Basic concepts, unit of refrigeration; C.O.P: Refrigerators, heat pump, Carnot refrigerators and applications of refrigerator; Air refrigeration cycle: Bell Coleman cycle, open and dense air system – ideal and actual refrigeration, applications, aircraft refrigeration cycles; Refrigerants: Desirable properties, nomenclature and selection of refrigerants, effects of refrigerants on ozone depletion and global warming, alternate refrigerants.

UNIT-III	VAPOUR COMPRESSION REFRIGERATION	Classes: 09

Vapor compression refrigeration, ideal cycle, effect of variation in evaporator pressure, condenser pressure, super heating of vapor, sub cooling of liquid.

Evaporator and condenser temperatures, deviations of practical (actual cycle) from ideal cycle, construction and use of p-h chart problems.

UNIT-IV	VAPOUR ABSORPTION REFRIGERATION	Classes: 09

Vapor absorption refrigeration: description, working of NH3-Water, Li Br–water system, calculation of HCOP, principle and operation of three fluid vapor absorption refrigeration systems, steam jet refrigeration system, working principle, basic operation, principle and operation of thermo electric and vortex tube or hilsch tube refrigeration systems.

UNIT-V	INTRODUCTION TO AIR CONDITIONING	Classes : 09

Psychometric properties and processes, sensible and latent heat loads, characterization, need for ventilation, consideration of infiltration, load concepts of RSHF, ASHF, ESHF and ADP; Concept of human comfort and effective temperature, comfort air conditioning, industrial air conditioning and requirements, air conditioning load calculations.

Text Books:

1. S. C. Arora, Domkundwar, “A Course in Refrigeration and Air-conditioning”, Dhanpatrai Publications, 2nd Edition, 2014. 2. C. P. Arora, “Refrigeration and Air Conditioning”, Tata McGraw-Hill, 17th Edition, 2006.
Reference Books:
1. Manohar Prasad, “Refrigeration and Air Conditioning”, New Age International, 3rd Edition, 2015. 2. P. N Ananthanarayanan, “Basic Refrigeration and Air Conditioning”, Tata McGraw-Hill, 2015.
Web References:
1. http://www.engineeringstudymaterial.net/tag/air-conditioning-and-refrigeration-books/ 2. https://www.en.wikipedia.org/wiki/Air_conditioning
E-Text Book:
1. http://www.mechanicalgeek.com/refrigeration-and-air-conditioning-by-rs-khurmi-pdf/ 2. http://www.engineeringstudymaterial.net/tag/air-conditioning-and-refrigeration-books/
Course Home Page:

LAUNCH VEHICLES AND CONTROLS

VII Semester: Common to all branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AAE553	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the various configurations of launch vehicles and application of controls.
II. Identify different tracking systems for launch vehicles.
III. Distinguish between different errors associated with navigation system and compensation errors.
IV. Compare the guidance systems for short medium and long range missile.

UNIT-I	INTRODUCTION	Classes: 10

Types of rockets and missiles, various configurations, components forces on the vehicle during atmospheric flight, nose cone design and drag estimation; Concepts of navigation ADF, VOR/DME, Doppler, LORAN and OMEGA, guidance and control; Introduction to basic principles; Air data information; Guidance trajectories; Radar systems; Principle of working of radar; Radar equations and applications; MTI and pulse Doppler radar; moving target detector; limitation of MTI performance.

UNIT-II	TRACKING WITH RADAR	Classes: 10

Mono pulse tracking: Conical scan and sequential lobbing; Automatic tracking with surveillance radar (ADT); CW radar; Applications; Other guidance systems; Gyros and stabilized platforms; Inertial guidance and laser based guidance; Components of inertial navigation system; imaging infrared guidance; Satellite navigation; GPS; Accelerometers.

UNIT-III	INERTIAL NAVIGATION SYSTEM	Classes: 09

INS transfer function and errors; Different coordinate system, compensation errors, schuler loops; Cross coupling; Missile control system; Guided missile concept; Augmented systems.

Control of aerodynamic missile; Missile parameters for dynamic analysis; Missile autopilot schematics; Longitudinal and Lateral autopilots.

UNIT-IV	MISSILE GUIDANCE	Classes: 08

Missile guidance laws, short and medium range missiles; Proportional navigation guidance; Command guidance; Comparison of guidance system performance; Bank to turn missile guidance; Terminal guidance; Weapon control missile guidance.

UNIT-V	INTEGRATED FLIGHT/FIRE CONTROL SYSTEM	Classes: 08

Director fire control system; Fire control modes; Tracking control laws; Longitudinal flight control system; Lateral flight control system; Rate of change of Euler angle, auto pilot; Integrated flight and fire control (IFFC) flight testing.

Text Books:

1. Merrilh I. Skolnik, “ Introduction to Radar Systems”, Tata McGraw-Hill, 3rd Edition, 2001.
2. John H Blakelock, “Automatic control of Aircraft and Missiles”, Wile –Inter Science Publication, 2nd Edition, May 1990.

Reference Books:
1. R.B. Underdown, Tony Palmer, "Navigation", Black Well Publishing, 6th Edition, 2001. 2. R P G Collinson, "Introduction to Avionics Systems", Kulwar Academic Publishers, 3rd Edition, 2003.
Web References:
1. http://home.iitk.ac.in/~sbasu/me623_2006/fem_notes_me623.pdf 2. http://nptel.ac.in/courses/112104116/ 3. http://www.me.berkeley.edu/~lwlin/me128/FEMNotes.pdf
E-Text Books:
1. http://www.civilenggforall.com/2015/09/finite-element-analysis-by-ss-bhavikatti-free-download-pdf-civilenggforall.com.html 2. https://books.google.co.in/books/about/Finite_Element_Analysis_For_Engineering.html?id=3XJoK4x5fZwC
Course Home Page:

INTELLECTUAL PROPERTY RIGHTS

IV Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS601	Perspective	L	T	P	C	CIA	SEE	Total
		-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: Nil		

OBJECTIVES:

The course should enable the students to:

I. Explore the knowledge in determination of trade secrets status.
II. Adequate knowledge in New Developments in trade law.
III. Understand the complexities involved in the process of attributing intellectual property rights to people.
IV. Learn the legalities of intellectual property to avoid plagiarism and other IPR relates crimes like copyright, infringements, etc.
V. Learn the fundamental principles and the application of those principles to factual, real-world disputes.

UNIT-I INTRODUCTION TO INTELLECTUAL PROPERTY

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT-II TRADE MARKS

Purpose and function of trademarks, acquisition of trademarks rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

UNIT-III LAW OF COPYRIGHTS AND LAW OF PATENTS

Fundamentals of copyrights law, originality of material, rights to reproduction, rights to perform the work publicly, copyright ownership issues.

Copyright registration, notice of copyright, international copyright law, foundation of patent law, patent searching process, ownership rights and transfer.

UNIT-IV TRADE SECRETS AND UNFAIR COMPETITION:

Trade secrets law, determination of trade secrets status, liability for misappropriations of trade secrets, protection for submission, trade secrets litigation, misappropriation of right of publicity and false advertising.

UNIT-V NEW DEVELOPMENTS OF INTELLECTUAL PROPERTY

New developments in trade law, copyright law, patent law, intellectual property audits international overview of intellectual property, international-trademark law, copyright law, international patent law, international development in trade secrets law.

Text Books:

1. Deborah. E. Bouchoux, "Intellectual Property Right", Cengage Learning, 4th Edition, 2013.
2. Prabuddha Ganguli, "Intellectual Property Right: Unleashing the Knowledge Economy", Tata McGraw Hill Publishing Company Ltd., 3rd Edition, 2005.

Reference Books:
1. Catherine J. Holland, "Intellectual Property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, CDR Edition, 2007. 2. Stephen Elias, "Patent, Copyright & Trademark: A Desk Reference to Intellectual Property Law", Lisa Goldoftas Publishers, Nolo Press, 1996.
Web References:
1. https://en.wikipedia.org/wiki/Intellectual_property 2. http://sokogskriv.no/en/sources-and-references/why-cite-sources/intellectual-property-rights/
E-Text Books:
1. http://www.e-booksdirectory.com/listing.php?category=269 2. http://www.lexisnexis.com/store/catalog/catalog.jsp?id=80
Course Home Page:

TOTAL QUALITY MANAGEMENT

IV Semester: **Common for all Branches**								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS602	**Perspective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**		**Practical Classes: Nil**			**Total Classes: Nil**		

OBJECTIVES:

The course should enable the students to:

I. Understand the philosophy and core values of Total Quality Management (TQM).
II. Determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization.
III. Apply and evaluate best practices for the attainment of total quality.
IV. Utilize Statistical Process Control (SPC) techniques as a means to diagnose, reduce and eliminate causes of variation.
V. Describe and apply the development and nature of quality control charts.

UNIT-I PRINCIPLES AND PRACTICES-1

Introduction, gurus of TQM, historic review, benefits of TQM leadership, characteristics of quality leaders, the deming philosophy, quality councils, strategic planning, customer satisfaction, customer perception of quality service quality, customer retention, employee involvement, employee survey-empowerment, gain sharing, performance appraisal.

UNIT-II PRINCIPLES AND PRACTICES-2

Continuous process improvement, the jurantrilogy, the PDCA cycle-kaizen, reengineering; Supplier partnership, partnering, sourcing, supplier selection, supplier rating, performance measures, basic concept, strategy quality cost bench marking, reasons for bench marking, process understanding current performance, pitfalls and criticism of benchmarking.

UNIT-III TOOLS AND TECHNIQUES-1

Information technology, computers and the quality functions, information quality issues, quality management system, benefits of ISO registration, ISO 9000 series standards, internal audits.

Environmental management system, ISO 14000series, benefits of EMS, relation to healthy and safety quality function deployment, the voice of the customer, building a house of quality, QFD process.

UNIT-IV TOOLS AND TECHNIQUES-2

Quality by design benefits, communication model, failure mode and effective analysis, failure rate, FMEA documentation, the process of FMEA documentation, product liability, proof and expert witness; Total productive maintenance, promoting the philosophy and training-improvements and needs, autonomous work groups.

UNIT-V MANAGEMENT TOOLS

Management tools introduction-forced field analysis, tree diagram, process decision program chart statistical process control, cause and effect diagram-histogram, state of control, process capability, experimental design, hypothesis, orthogonal design two factors and full factors-quality strategy for Indian industries, quality management in India.

Text Books:
1. Joel E Ross, “Total Quality Management”, CRC Press, 3rd Edition, 2015
Reference Books:
1. Dale H. Besterfeild, Carlon Besterfeild, “Total Quality Management”, Pearson Education,1st Edition, 2015 2. Sridhara Bhat, “Total Quality Management Texts and Cases”, Himalaya, 1st Edition, 2015. 3. Poornima M Charantimath, “Total Quality Management”, Pearson Education, 1st Edition, 2015.
Web References;
1. http://managementhelp.org/quality/total-quality-management.htm 2. http://www.tandfonline.com/toc/ctqm20/current
E-Text Books:
1. https://www.scribd.com/doc/19378602/Quality-Management-eBook 2. http://bookboon.com/en/quality-management-ebook
Course Home Page:

PROFESSIONAL ETHICS AND HUMAN VALUES

IV Semester: Common for all Branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS603	Perspective	L	T	P	C	CIA	SEE	Total
		-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: Nil		

OBJECTIVES:

The course should enable the students to:

I. Understand the fundamental theoretical and historic graphical topics of professional ethics and human values.
II. Study independence and self-evaluation professional ethics and human values, so that they can grasp the core values as independent thinkers.
III. Develop their analytical and pragmatic abilities & situational reasoning aligned towards right and wrong.

UNIT-I INTRODUCTION TO PROFESSIONAL ETHICS

Basics of profession: Engineering and professionalism, two models of professionalism, three types of ethics or morality, the negative face of engineering ethics, the positive face of engineering ethics, responsibility in engineering, engineering standards, the standard care, blame responsibility and causation.

UNIT-II PROFESSIONAL ETHICS IN ENGINEERING

Engineering ethics , variety of moral issues, types of inquiry moral dilemmas, moral autonomy, the problems of many hands, Kohlburg's theory, Gilligan's theory impediments to responsible action, engineering as social experimentation, framing the problem, determining the facts, codes of ethics, clarifying concepts application issues, common ground, general principles, utilitarian thinking respect for persons.

UNIT-III ETHICS AND HUMAN VALUES

Human values, morals, values, and ethics, integrity, work ethic, service learning, civic virtue, respect for others, living peacefully.

Caring, sharing, honesty, courage, valuing time, co-operation, commitment, empathy, self-confidence, spirituality, character.

UNIT-IV MORAL RESPONSIBILITIES & RIGHTS

Ethics consensus, controversy, models of professional roles, theories about right action, self, interest, customs and religion, uses of ethical theories, responsibility for rights, respect for authority, conflicts of interest, occupational crime, professional rights and employee rights, communicating risk and public policy, collective bargaining.

UNIT-V GLOBAL ETHICS & VALUES

Global issues, multinational corporations, environmental ethics, engineers as managers, advisors, and experts witnesses, moral leadership sample codes of ethics problem of bribery, extortion and grease payments, problem of nepotism, excessive gifts, paternalism, different business practices, negotiating tax, global trends.

Text Books:
1. PSR Murthy, "Indian Culture Values and Professional Ethics", BS Publications, 1st Edition, 2013. 2. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 3rd Edition, 2003. 3. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, 4th Edition, 2012. 4. George Reynolds, "Ethics in Information Technology", Cengage Learning, 5th Edition, 2012.
Reference Books:
1. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, 4th Edition, 2004. 2. Charles E Harris, Micheal J Rabins, "Engineering Ethics", Cengage Learning, 5th Edition, 2014. 3. Edmund G Seebauer, Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 1st Edition, 2000.
Web References:
1. http://www.imd.inder.cu/adjuntos/article/524/Professional%20Ethics%20and%20Human%20Values.pdfhttp://bit.ly/29SyL7i 2. https://books.google.com/books/about/Textbook_on_Professional_Ethics_and_Huma.html?id=-dPiHmlV_
E-Text Books:
1. https://www.amazon.com/Professional-Ethics-Human-Values-Govindarajan-ebook/dp/B00K6GSSUW 2. http://bookboon.com/en/business-ethics-ebook
Course Home Page:

LEGAL SCIENCES

IV Semester: **Common for all Branches**

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Tota
AHS604	Perspective	-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: Nil		

OBJECTIVES:

The course should enable the students to:

I. Acquaint the student with the scientific method of social science research.
II. Provide the knowledge of the technique of selection, collection and interpretation of primary and secondary data in socio legal research.
III. Emphasis would be laid on practical training in conducting research.

UNIT-I CONCEPT OF LEGAL SCIENCE

Fundamentals of legal science, law systems in India, comparative public law, law and justice in a globalizing world. Impact of the human rights instruments on domestic law.

UNIT-II TECHNOLOGY & LEGAL SYSTEMS

Principles of corporate law conjunction, temporal, subordinate clauses complex sentences, intellectual property rights, contract law, cyber law.

UNIT-III CONSTITUTION AND ADMINISTRATIVE LAW

Minorities law, human rights, international and national sphere, media law.

Health law, globalization vis-à-vis human rights, significance of human rights.

UNIT-IV HUMAN RIGHTS INTERNATIONAL AND NATIONAL SPHERE

Human rights with special reference to right to development, rights of disadvantaged and vulnerable groups, critical analysis, cultural relativism and human rights, human rights in the Indian sphere, an over view, constitution and the analysis of preamble, social action litigation and the role of Indian judiciary, critical examination of the human rights council and human rights commission, treaty mechanism with respect to covenants ICESCR and ICCPR, convention on the elimination of discrimination against women and child rights convention.

UNIT-V SCIENTIFIC METHODOLOGY IN LEGAL SYSTEMS

The science of research and scientific methodology ,analysis of law with scientific methods, scientific approach to socio legal problems, interrelation between speculation, fact and theory building fallacies of scientific methodology with reference to socio legal research ,inter-disciplinary research and legal research models, arm chair research vis-a-vis empirical research, legal research-common law and civil law legal systems.

Text Books:

1. Robert Watt, "Concise book on Legal Research", Abe Books publishers, 1st Edition, 2015.
2. Ram Ahuja, "Research Method", NewsWay Publishers, 1st Edition, 2012.
3. Goode and Hatt, "Research Methodology", Eastern Limited Publication, 1st Edition reprinted, 2006

Reference Books:

1. B. Somekh & C. Lewin, "Research Methods", Vistaar Publications, 1st Edition, 2005.
2. Bhandarkar, "Research Methods, Research styles and Research Strategies", Wilkinson Publishers, 1st Edition, 2009.

Web References:

1. http://humansecurityconf.polsci.chula.ac.th/Documents/Presentations/Shanawez.pdf
2. http://www.lexisnexis.com/documents/pdf/20080806034945_large.pdf
3. http://www.theglobaljusticenetwork.org/journal
4. http://humansecurityconf.polsci.chula.ac.th/Documents/Presentations/Shanawez.pdf
5. http://as.nyu.edu/docs/IO/1172/globaljustice.pdf

E-Text Books:

1. www.bookboon.com/en/natural-sciences-eBooks

Course Home Page:

CLINICAL PSYCHOLOGY

IV Semester: **Common for all Branches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS605	**Perspective**	-	-	-	-	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: Nil**		

OBJECTIVES:

The course should enable the students to:

I. Develop the knowledge pertinent to the organism, developmental, social and situational factors those are relevant to the initiation and maintenance of human behavior.
II. Understand the present and implement effective strategies to deal with these issues during work with patients.
III. Study the professional identity and practice as clinical psychologists through fundamental knowledge of psychology, commitment to professional ethics.
IV. Understand the multiculturalism, diversity and participation in life-long learning.

UNIT-I BASIC PSYCHOLOGY

Introduction: Psychology, definition, psychology as a science, early schools of psychology, modern perspectives, methods of psychology, experimental method, systematic observation, case study method, survey method, fields of psychology.

UNIT-II BIOLOGY OF BEHAVIOR AND SENSORY PROCESS

Neurons and synapses: Nervous system , peripheral and central nervous system: brain and sleep: importance of fore brain, association cortex, left and right hemisphere functions; Some general properties of senses, subliminal stimuli, the visual sense, auditory sense, the other senses; Consciousness, meaning, functions, divided consciousness, stages of sleep, dreams, meditation, hypnosis.

UNIT-III ATTENTION AND PERCEPTION

Selective attention; physiological correlates of attention, internal influences on perception, learning set, motivation and emotion, cognitive styles.

External influences on perception, figure ground, movement, illusions, perceptual organization, constancy, depth perception, binocular and monocular cues.

UNIT-IV MOTIVATION AND EMOTION MOTIVES

Definitions, motivation cycle, theories of motivation, biological motivation, social motives, frustration and conflicts of motives, defense mechanism, emotion, expression and judgment of emotion, the physiology of emotion, theories of emotion.

UNIT-V CLINICAL PSYCHOLOGY & MENTAL HEALTH

History of clinical psychology and its role in understanding and alleviation of mental illness, promotion of mental health and rehabilitation of the mentally ill, role and functions of clinical psychologists in DMHP, professional code of conduct and ethical issues.

Text Books:

1. M. S. Bhatia, "Clinical Psychology", B J Publishers, 1st Edition, 2008.
2. Paul Bennett, "Abnormal and Clinical Psychology: An Introductory Textbook", Pearson Publishers, 2nd Edition, 2006.

Reference Books:

1. Robert A. Baron, Girishwar Misra, "Psychology: Indian Subcontinent Edition", Pearson Education, 5th Edition, 2009.
2. HillGard, E. R., C. A. Richard, L. A. Rita, "Introduction to Psychology", Oxford & IBH, New Delhi, 6th Edition, 1976.

Web References:

1. https://www.amazon.com/Clinical-Psychology-Counseling-Books/b?ie=UTF8&node=11143
2. https://global.oup.com/academic/content/series/o/oxford-textbooks-in-clinical-psychology-otcp/?cc=in&lang=en&

E-Text Books:

1. https://www.amazon.com/Clinical-Psychology-Counseling-Books/b?ie=UTF8&node=11143
2. https://books.google.co.in/books/about/Clinical_Psychology.html?id=u4aDPdw0Fi4C&redir_esc=y

Course Home Page:

ENGLISH FOR SPECIAL PURPOSES

IV Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS606	Perspective	L	T	P	C	CIA	SEE	Total
		-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: Nil		

OBJECTIVES:

The course should enable the students to:

I. Learn the structure and style of effective sentences, paragraphs, and essays.
II. Focus on diction and spelling, punctuation and mechanics, and functional grammar in direct relation to students' own writing.
III. Understand and apply the basic conventions of syntax and mechanics; and proofread competently and prepare acceptable manuscripts.
IV. Emphasize the importance of language in academic and employability
V. Empower the communicative skills which enhance the employability skills with self-confidence.

UNIT-I PRESENTATION SKILLS

English presentation, effective presentation, live presentation, web access, language orientation, classifications, method of presentations, declarations ,impact, concepts of presentation, skill oriented presentations, analysis of presentation, types of presentations.

UNIT-II NON-VERBAL COMMUNICATION

Overview, this unit includes body language, posture, distance different levels of physical closeness appropriate to different types of relationship, right usage of gestures, open and closed postures, to be aware of facial expressions and their importance in non verbal communication.

UNIT-III INTERPERSONAL SKILLS

To build rapport, handling the criticism, giving and receive the feedback, be assertive, influencing and negotiation skills.

Methods of interpersonal skills, problem solving, decision making, verbal communication, peer negotiation, effective participating.

UNIT-IV LISTENING

Listen effectively, how to make notes, the difference between active listening and passive listening to understand different dialects. Initiating the contact, the important context in communicating. the reluctant speaker, appendices, problems in listening.

UNIT-V SPEAKING AND READING

Actively participate in GDs and debates, deal with JAM topics, answer questions in interviews, vocabulary section, useful information, discussing, socializing the effectiveness; How to read critically, to understand the main idea and tone of the author to understand complex ideas.

Text Books:
1. Susan E. Boyer, "Word Building Activities for Beginners of English" Birrong Book Publishers, 1st Edition, 2009. 2. Clive Oxenden, Christina Latham-Koenig, Paul Seligson, "New English File. Intermediate. Workbook", Oxford Publications,1st Edition,2006. 3. P Peter Bullions, "Practical Lessons in English Grammar and Composition", ESL Publications,1st Edition, 1849.
Reference Books:
1.Wren and Martin, "High school English Grammar and Composition", S Chand Publications, 1st Edition, 2013. 2. Ron Cowan, "The Teacher's Grammar of English, Cambridge University Press, 1st Edition, 2008
Web References:
1. http://www.cde.ca.gov/be/st/ss/documents/englangdevstnd.pdf 2. http://ell.stanford.edu/sites/default/files/ELP_task_force_report_rev.pdf
E-Text Books:
1. http://www.linguistik-online.org/40_09/dahmardeh.pdf 2. http://bookboon.com/en/english-language-ebooks
Course Home Page:

ENTREPRENEURSHIP

IV Semester: **Common for all Branches**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS607	Perspective	-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: Nil		

OBJECTIVES:

The course should enable the students to:

I. Identify and apply the elements of entrepreneurship and to entrepreneurial processes;
II. Recognize the importance of entrepreneurship and identify the profile of entrepreneurs and their role in economic growth.
III. Analyze the business environment, opportunity recognition, and the business idea-generation process;
IV. Develop an idea on the legal framework and also understand strategic perspectives in entrepreneurship.

UNIT-I **UNDERSTANDING ENTREPRENEURIAL MINDSET**

Revolution impact of entrepreneurship; The evolution of entrepreneurship; Approaches to entrepreneurship; Process approach; Twenty first centaury trends in entrepreneurship.

UNIT-II **THE INDIVIDUAL ENTREPRENEURIAL MINDSET**

The individual entrepreneurial mind set and personality, the entrepreneurial journey, stress and the entrepreneur, the entrepreneurial ego, entrepreneurial motivation, corporate entrepreneurial mindset the nature of corporate entrepreneur, conceptualization of corporate entrepreneurship strategy sustaining corporate entrepreneurship.

UNIT-III **LAUNCHING ENTREPRENEURIAL VENTURES**

Opportunities identification, entrepreneurial imagination and creativity, the nature of the creativity process, innovation and entrepreneurship, methods to initiate ventures.

Creating new ventures acquiring an established entrepreneurial venture, franchising-hybrid disadvantage of franchising.

UNIT-IV **LEGAL CHALLENGES OF ENTREPRENEURSHIP**

Intellectual property protection, patents, copyrights trademarks and trade secrets-avoiding trademark pitfalls, formulation of the entrepreneurial plan, the challenges of new venture start-ups, poor financial understanding, and critical factors for new venture development-the evaluation process-feasibility criteria approach.

UNIT-V **STRATEGIC PERSPECTIVES IN ENTREPRENEURSHIP**

Strategic planning, strategic actions, strategic positioning business stabilization, building the adaptive firms-understanding the growth stage, unique managerial concern of growing ventures.

Text Books:

1. D F Kuratko, T V Rao, “Entrepreneurship: A South Asian Perspective”, Cengage Learning, 1st Edition, 2012.
2. Gordon, K. Natarajan, “Entrepreneurship Development”, Himalaya, 4th Edition, 2008.

3. Coulter, “Entrepreneurship in Action”, PHI, 2nd Edition, 2002.
4. S. S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Ltd, 5th Edition, 2007.

Reference Books:

1. Vijay Sathe, “Corporate Entrepreneurship”, Cambridge, 1st Edition, 2009.
2. Vasanth Desai, “Dynamics of Entrepreneurial Development and Management”, HPH, Millenium Edition, 2007.
3. P. Narayana Reddy, “Entrepreneurship – Text and Cases”, Cengage Lerning”, 1st Edition, 2010.
4. David H. Hott, “Entrepreneurship New Venture Creation”, PHI, 1st Edition, 2004.

Web References:

1. http://www.tutorialspoint.com/entrepreneurship_development/entrepreneurship_development_tutorial.pdf
2. http://www.advalue-project.eu/content_files/EN/33/AdValue_Personal_Effectiveness_EN.pdf

E-Text Books:

1. http://www.freebookcentre.net/Business/Entrepreneurship-Books.html
2. http://www.e-booksdirectory.com/listing.php?category=390
3. http://www.bookboon.com/en/entrepreneurship-ebooks

Course Home Page:

GERMAN LANGUAGE

IV Semester: Common for all Branches								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHS608	Perspective	L	T	P	C	CIA	SEE	Total
		-	-	-	-	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: Nil		

OBJECTIVES:

The course should enable the students to:

I. Complete reading, writing, speaking, and listening assignments with ever increasing proficiency and accuracy.
II. Increase grammatical accuracy on written assignments.
III. Implement the language skills in listening, speaking, reading and writing in German language.

UNIT-I GERMAN SOUNDS

Vowels, consonants, diphthongs, umlaut, the nouns, gender distinctions, cases, definite and indefinite articles, conjugation of verbs, verbs with separable and inseparable prefixes, modal verbs, personal pronouns, possessive pronouns, reflexive pronouns, cases nominative, accusative and dative; Structure of sentence and categories of sentences, subordinate clause, causative and conditional sentences; A very interesting slideshow presentation is held to enlighten the students about the culture, people, and lifestyle in Germany.

UNIT-II SENTENCES FORMATION

Infinite sentences, use of conjunctive and conjunctive ii (contd.) plus quam perfect, modal verb (contd.) Conjunction, temporal, subordinate clauses complex sentences.

UNIT-III GERMAN BASIC GRAMMAR

Verbs: Different forms, past tense and present perfect tense, adjectives and their declension, degrees of comparison; Prepositions, genitive case, conjunctive.

Different conjunctions (co-ordinating and subordinating), simple, complex and compound sentences, active and passive voice, relative pronouns.

UNIT-IV PURPOSE OF LANGUAGE STUDY

Pictures and perceptions, conflicts and solutions, change and the future, the purpose of the study of the German language, listening, understanding, reacting, speaking, communicating, use of language, pronunciation and intonation ,reading, reading and understanding, writing, text writing, text forming, use of language, language reflection, building up the language, language comparison, culture reflection, other cultures and cultural identity.

UNIT-V GERMAN ADVANCED COMMUNICATION LEVEL-1

The significance of language study 1. Speaking and thinking 2. Self – discovery 3. Communication 4. Language Competence 5. Language and culture 6. Language changes 7. Connection with other areas of study 8. The mother—language 9. Other languages.

Text Books:
1. Korbinian, Lorenz Nieder Deutschals Fremdsprache IA. Ausländer ,"German Language", Perfect Paperback Publishers, 1st Edition, 1992. 2. Deutsch alsFremdsprache, IB, Ergänzungskurs, "German Language", Front Cover. Klett, Glossar Deutsch-Spanisch Publishers, 1st Edition, 1981.
Reference Books:
1. Griesbach, "Moderner Gebrauch der deutschen Sprache", Schulz Publishers, 10th Edition, 2011. 2. Anna Quick , Hermann Glaser U.A , "Intermediate German: A Grammar and workbook", Paperback, 1st Edition,2008.
Web References:
1. http://www.prsformusicfoundation.com/docs/408/Schenke%20-%20Seago%20-%20Basic%20German.pdf 2. https://upload.wikimedia.org/wikipedia/commons/2/2d/German.pdf
E-Text Books:
1. http://www.staidenshomeschool.com/files/Learning_German_Ebook.pdf
Course Home Page:

DESIGN HISTORY

IV Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS609	**Perspective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: Nil**		

OBJECTIVES:

The course should enable the students to:

I. Understand the fundamental theoretical and historiographical topics of design, from the fifties of the twentieth century to the present day.
II. Use methodological tools and develop their analytical and critical capacities, so that they can grasp the bonds that link works of design with their respective social, economic and cultural backdrop.
III. Identify the influences at work between the various different creative disciplines.
IV. Develop their analytical and critical abilities, focusing on their search for their own expressive design language.

UNIT-I **INTRODUCTION TO DESIGN HISTORY**

Materials and techniques of design, design in the machine age, design body, environmental design.

UNIT-II **DESIGN PRODUCTS**

Innovative ideas of design products, intellectual and creative research, commercial and critical perspectives on design products, social, ethical and economic impact of your design.

UNIT-III **GLOBAL INNOVATION IN DESIGN**

Styles of global innovation design, the service design basics.

Concepts of vehicle design, techniques of design engineering (IDE).

UNIT-IV **THE DESIGN INTERACTIONS**

Interaction design, digital media, fine art, products, graphic and furniture design, architecture, life sciences, biotech, social sciences, and computer science, human consequences of different technological design futures.

UNIT-V **RESEARCH IN DESIGN HISTORY**

Research in craftsmanship and artisanal cultures, design, trade and exchange, design exhibitions, curatorial practice, history and theory, design and national, global identities, the design and material culture of the domestic interior, material history and the history of materiality, Asian design history.

Text Books:

1. R. S. Khurmi, "A Textbook of Machine Design", Eurasia Publishing House (pvt.) Ltd., 14th Edition, 2005.
2. Nicolas, "Beyond Design Ethnography", Nova Publishers, 2nd Edition, 2014.
3. Mariana Amatullo, "Career Pathways in Design for Social Innovation; Design matters at Art Center College of Design", LEAP Dialogues, 1st Edition, 2016.

Reference Books:

1. Max Bruinsma, "Design for the Good Society", Paperback, 1st Edition, 2015.
2. Beppe Finessi, "How to Break the Rules of Brand Design", Global Publishers, 1st Edition, 2009.

Web References:

1. https://en.wikipedia.org/wiki/Web_design
2. https://en.wikipedia.org/wiki/Responsive_web_design

E-Text Books:

1. http://www.creativebloq.com/design/free-ebooks-designers-7133700
2. https://www.amazon.com/Designing-History-East-Asian-Textbooks/dp/0415855586

Course Home Page:

GENDER SENSITIVITY

III Semester: Common for all Branches								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AHS017	**Perspective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: Nil**		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic concepts relating to gender and to provide logical understanding of gender roles.
II. Analyze present various perspective of body and discourse on power relationship.
III. Develop cultural construction of masculinity and femininity.
IV. Study the evolution of gender studies from women's studies

UNIT-I	**INTRODUCTION**

Sex and gender; types of gender, gender roles and gender division of labour, gender stereotyping and gender discrimination-the other and objectification, male gaze and objectivity.

UNIT-II	**GENDER PERSPECTIVES OF BODY**

Biological-phenomenological and socio-cultural perspectives of body, body as a site and articulation of power relations- cultural meaning of female body and women's lived experiences -gender and sexual culture.

UNIT-III	**SOCIAL CONSTRUCTION OF FEMININITY**

Bio-social perspective of gender, gender as attributional fact, essentialism in the construction of femininity, challenging cultural notions of femininity.

Butler, Douglas, Faucault and Haraway, images of women in sports, arts, entertainment and fashion industry, media and feminine identities.

UNIT-IV	**SOCIAL CONSTRUCTION OF MASCULINITY**

Definition and understanding of masculinities, sociology of masculinity, social organization of masculinity and privileged position of masculinity, politics of masculinity and power, media and masculine identities.

UNIT-V	**WOMEN'S STUDIES AND GENDER STUDIES**

Evolution and scope of women's studies, from women‘s studies to gender studies: A paradigm shift, women's studies vs. gender studies, workshop, gender sensitization through gender related.

Text Books

1. Gender, "How Gender Inequality Persists in the Modern World", Oxford University Press, Reprinted Edition, 2011.
2. William M Johnson, "Recent reference books in religion" ,Duke University Publications, Reprinted Edition, 2014

Reference Books
1. Alolajis.Mustapha, Sara Mils,"Gender representation in learning materials", Pearson Publications, 1st Edition, 2015.
Web References:
1. https://www.google.co.in/search?q=clinical++pscyology+ebooks&ie=utf-8&oe=utf-8&client=firefox-b-ab&gfe_rd=cr&ei=xPmJV6OhFcuL8Qf3qam4Cw#q=gender+sensitivity+web+references 2. https://en.wikipedia.org/wiki/Gender_sensitization
E-Text Books:
1. http://ebooklibrary.org/articles/gender_sensitization 2. http://cbseacademic.in/publication_ebooks.html
Course Home Page:

CNC TURNING PART PROGRAMMING

VI SEMESTER: MECH								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME801	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes:	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:		

OBJECTIVES:

The course should enable the students to:

I. Understand the features and specifications of CNC and 3D printing machines.
II. Develop the process planning sheets and tool layouts.
III. Use the CAM software and prepare CNC part programs.
IV. Execute the part program and machine the component as per the production drawing.

UNIT - I INTRODUCTION TO AUTOMATION

Introduction to Automation – Goals of Automation, levels of automation, Hard Vs Soft Automation, Computer Aided manufacturing (CAM).

Numerical Control - Introduction, Role of NC / CNC in CAM, Applications of NC / CNC, Benefits of NC / CNC, Limitations of CNC.

UNIT - II COMPONENTS

Basic Components of CNC system - Part programming, Machine control unit, Machine tool - Historical developments and their role in control of machine tools

UNIT - III CLASSIFICATION

Classification of NC / CNC systems - Based on type of Control (PTP\C\L), method of programming, type of architecture - Hardwired / Soft wired / Open.

UNIT-IV CONTROL UNIT

Machine Control Unit - Data processing Unit - elements and their functions - Interpolators and Sequential Controllers

UNIT - V PART PROGRAMMING

Part programming - Introduction; Part Program and its elements, Methods of Programming - Manual and Computer Assisted Part programming - Custom Macro (Parametric Programming), APT and its variations, Concepts of CAM - Tool path generation and control method

Text Books:

1. Koren Y, Computer Control of Manufacturing systems, McGraw Hill, 1986.

Reference Books:

1. Reinbold U, Blume C and Dilmann R, Computer Integrated Mfg. Technology & Systems,
2. Marcel Dekker, 1985. 3. Petruzella F D, Programmable Logic Controllers, McGraw Hill, 1989.

CNC MILLING PART PROGRAMMING

VI SEMESTER: MECH								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME802	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes:	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:		

OBJECTIVES:

The course should enable the students to:

I. Understand the features and specifications of CNC and 3D printing machines.
II. Develop the process planning sheets and tool layouts.
III. Use the CAM software and prepare CNC part programs.
IV. Execute the part program and machine the component as per the production drawing.

UNIT - I INTRODUCTION TO AUTOMATION

Introduction to Automation – Goals of Automation, levels of automation, Hard Vs Soft Automation, Computer Aided manufacturing (CAM).

Numerical Control - Introduction, Role of NC / CNC in CAM, Applications of NC / CNC, Benefits of NC / CNC, Limitations of CNC.

UNIT - II COMPONENTS

Basic Components of CNC system - Part programming, Machine control unit, Machine tool - Historical developments and their role in control of machine tools

UNIT - III CLASSIFICATION

Classification of NC / CNC systems - Based on type of Control (PTP\C\L), method of programming, type of architecture - Hardwired / Soft wired / Open.

UNIT-IV CONTROL UNIT

Machine tools Classification of NC / CNC systems - Based on type of Control (PTP\C\L), method of programming, type of architecture - Hardwired / Soft wired / Open.

UNIT - V PART PROGRAMMING

Part programming - Introduction; Part Program and its elements, Methods of Programming - Manual and Computer Assisted Part programming - Custom Macro (Parametric Programming), APT and its variations, Concepts of CAM - Tool path generation and control method

Text Books:

1. Koren Y, Computer Control of Manufacturing systems, McGraw Hill, 1986.

Reference Books:

1. Reinbold U, Blume C and Dilmann R, Computer Integrated Mfg. Technology & Systems,
2. Marcel Dekker, 1985. 3. Petruzella F D, Programmable Logic Controllers, McGraw Hill, 1989.

INDUSTRIAL ENGINEERING

VI SEMESTER: MECH								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME803	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes:	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:		

OBJECTIVES:

The course should enable the students to:

I. Understand the PPC function in industrial manufacturing scenario.
II. Apply forecasting techniques for different types of products.
III. Knowledge in optimal inventory control and capacity planning.
IV. Estimate the standard timings for the given job using different time study methods.

UNIT - I INTRODUCTION

Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

UNIT - II MANAGEMENT FUNCTION

Management Function: Principle of Management – Time and motion study, work simplification – process charts and flow diagrams, Production Planning.

UNIT - III INVENTORY CONTROL

Inventory Control: Inventory, Cost, Deterministic Models and Introduction to Supply Chain Management.

UNIT-IV QUALITY CONTROL

Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

UNIT - V DEMAND FORECASTING AND COST ESTIMATION

Demand Forecasting and cost Estimation: Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break-Even Analysis.

Text Books:

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.
2. Industrial Engineering and Management Science/T.R. Banga and S.C.Sarma/Khanna Publishers.

Reference Books:

1. Motion and Time Study by Ralph M Barnes! John Willey & SonsWork Study by lLO.
2. Human factors in Engineering & Design/Ernest J McCormick / TMH.
3. Production & Operation Management /Paneer Selvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Hand Book /Maynard.
6. Industrial Engineering Management I RaviShankar/ Galgotia.

3D PRINTING TECHNOLOGY

VI SEMESTER: MECH								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME804	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes:	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:		

OBJECTIVES:

The course should enable the students to:

I. Understand the manufacturing and production concepts.
II. Analyze and understand about the automation system.
III. Able to use the automation systems in manufacturing line.
IV. Use different types of 3D printing materials, along with multi nozzle systems to control process parameters

UNIT - I INTRODUCTION

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Classification of Rapid Manufacturing Processes: Additive, Subtractive, Formative, Generic RP process.

UNIT - II MANAGEMENT FUNCTION

CAD Modeling and Data Processing for RP:CAD model preparation, Data interfacing: formats (STL, SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP), conversation, validity checks, repair procedures; Part orientation and support generation, Support structure design, Model Slicing algorithms and contour data organization, direct and adaptive slicing, Tool path generation.

UNIT - III INVENTORY CONTROL

RP Processes: Process Physics, Tooling, Process Analysis, Material and technological aspects, Applications, limitations and comparison of various rapid manufacturing processes.

UNIT-IV QUALITY CONTROL

Photo polymerization: (Stereo lithography (SL),Powder Bed Fusion (Selective laser Sintering (SLS), Electron Beam melting (EBM)), Extrusion-Based RP Systems (Fused Deposition Modeling (FDM)), 3D Printing, Sheet Lamination (Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC)), Beam Deposition (Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD)).

UNIT - V DEMAND FORECASTING AND COST ESTIMATION

Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS.

Text Books:

1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
2. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.

Reference Books:

1. Noorani R, "Rapid Prototyping: Principles and Applications in Manufacturing", John Wiley & Sons.
2. Liou W L, Liou F W, "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press.

ENERGY CONSERVATION AND MANAGEMENT

VII Semester: MECH									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME805	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes:	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:		

OBJECTIVES:

The course should enable the students to:

I. Understand the fuels and combustion in relation to energy conservation.
II. Understand the properties and sources of steam.
III. Learn about the energy saving methods.
IV. Understand the waste heat recovery.

UNIT- I FUELS AND COMBUSTION, BOILERS

Introduction to Fuels, Properties of Fuel oil, Coal and Gas, Storage, handling and reparation of fuels, Principles of Combustion, Combustion of Oil, Coal, and Gas.
Boilers: Types, Combustion in boilers, Performances evaluation, Analysis of losses, Feed water 06 treatment, Blow down, Energy conservation opportunities, Industrial Case Studies.

UNIT - II STEAM SYSTEM

Properties of steam, Assessment of steam distribution losses, Steam leakages, Steam Condensate and flash steam recovery system, Identifying opportunities for energy savings, Industrial Case Studies.

UNIT - III INSULATION and COGENERATION

Insulation-types and application, Economic thickness of insulation, Heat savings and application criteria.

Cogeneration: Definition, Need, Application, Advantages, Classification, Saving potentials, Industrial Case Studies.

UNIT - IV WASTE HEAT RECOVERY

Waste Heat Recovery: Classification, Advantages and applications, Commercially viable waste 02 Heat recovery devices, saving potential.

UNIT - V COOLING TOWER

Cooling Tower: Types and performance evaluation, Efficient system operation, Flow control 04 strategies and energy saving opportunities, Assessment of cooling towers.

Text Books:

1. Parmenter, Kelly E., Smith, Craig B., “Energy Management Principles, Second Edition: Applications, Benefits, Savings”, 2nd Edition, 2016.
2. Vesma Vilnis., “Energy Management Principles and Practice”, ISBN: 0580740196 (2011).

Reference Books:

1. Frank Kreith, D. Yogi Goswami, “Energy Management and Conservation Handbook”, 2nd Edition, 2016.
2. Yaşar Demirel, “Energy: Production, Conversion, Storage, Conservation, and Coupling”, 2016.

LUBRICATION ENGINEERING

VII Semester: MECH									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME806	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes:	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:		

OBJECTIVES:

The course should enable the students to:

I. Understand the properties of lubricants for the design and operation of components.
II. Understand the genesis of friction and wear.
III. Learn about the lubrication regimes, hydrodynamic lubrication and hydrostatic lubrication.
IV. Understand manufacture of lubricants.

UNIT - I PHYSICAL PROPERTIES OF LUBRICANTS

Introduction, Oil viscosity, Viscosity temperature relationship, Viscosity index, Viscosity pressure relationship, Viscosity-shear rate relationship, Viscosity measurements, Viscosity of mixtures, Oil viscosity classification, Lubricant density and specific gravity, Thermal properties of lubricants, Temperature characteristics of lubricants, Other lubricants characteristics, Optical properties of lubricants, Additive compatibility and solubility, Lubricant impurities and contaminants, Solubility of gases in oils.

UNIT- II FLUID FILM LUBRICATION

Regimes of fluid film lubrication, Hydrodynamic Lubrication; Introduction, Generalized Reynolds equation, Converging-diverging wedges, Journal bearings, Thermal effects in bearings, Limits of hydrodynamic lubrication, Hydrodynamic lubrication with non-Newtonian fluids, Reynolds equation for squeeze films, Porous bearings. Hydrostatic Lubrication; Basic concepts, Aerostatic bearings, Hybrid bearings, Stability of journal bearings.

UNIT- III THEORY OF LUBRICATION

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

Oil refining, types, categories, grading, Grease - composition, function, characteristics, thickeners and additives, soap and its complexes, selection and its practices, solid lubricants, performance enhancing, lubricant protective.

UNIT- IV MANUFACTURE OF LUBRICANTS

Lubricants and Their Composition: Introduction, Mineral oils, Synthetic oils, Emulsions and aqueous lubricants, Greases, Lubricant additives. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT- V LUBRICANTS APPLICATIONS

Tribological components and industrial machinery, Lubricants testing and test methods, Organisation and management of lubrication, lubricant storage and handling, Safety and health hazards, environmental regulations.

Text Books:

1. Khonsari, M. M., Booser, E. R., "Applied Tribology: Bearing Design and Lubrication", Ed, Wiley, 2nd Edition. 2008.
2. Conner, J.J. and Boyd, J., "Standard Handbook of Lubrication Engineering", McGraw Hill Publications, 1968.

Reference Books:

1. A.R.Lansdown, "Lubrication – A Practical Guide to Lubricant Selection", Pergamon Press, 1982.
2. Raymond.C.Gunther, "Lubrication", Chilton Book Co.,1971.

PRINCIPLES OF MATERIAL SELECTION

VII Semester: MECH								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME807	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes:	Tutorial Classes:	Practical Classes: Nil			Total Classes:			

OBJECTIVES:

The course should enable the students to:

I. Understand the physical and mechanical, metallurgical engineering concepts for metals and preparation of alloys.
II. Analyze the microstructures of metals, alloys and relationship to heat treatment.
III. Understand various criteria for selection of materials for different applications.

UNIT- I SELECTION CRITERIA

Selection criteria, service requirement, design fabricability, function ability, structure-property relationship reappraisal of the role of microstructure; crystal structure and defect structure vis-à-vis properties; materials and their applications, compositions, codes and properties.

UNIT- II FERROUS MATERIALS

Applications of important ferrous materials like stainless steels, managing steels, tool and die steels, high speed steels, and alloyed cast irons: their composition, heat treatment and properties.

UNIT - III NON-FERROUS MATERIALS

Applications of important non ferrous metals like Cu base, Al base, Ti base and Mg base alloys: their compositions, heat treatment, and properties.

UNIT -IV COMPOSITES

Some important composites like metal-matrix and composite, ceramic matrix composites: their composition, preparation, properties and their applications, some important structural ceramics.

UNIT -V WEAR RESISTANCE ALLOYS

Thermoplastic, thermo setting polymers and elastomers: structures, properties and specific applications. Important wear resistant alloys for hydro and thermal power stations; low and high temperature materials.

Text Books:

1. H.S Ray and A. Gosh, "Principle of Extractive Metallurgy", New Age International Publishers, 2nd Edition, 1999.
2. Raghavan, V., "Physical Metallurgy: Principles and Practice", Prentice-Hall of India, 2nd Edition, 2007.
3. Raghavan, V., "Materials Science and Engineering: A First Course", Prentice-Hall of India, 5th Edition, 2004.

Reference Books:

1. L. Carl Love, "Principle of Metallurgy", Brady, 2nd Edition, 1985.
2. Callister, W.D. Jr., "Material Science and Engineering – An Introduction", John Wiley and Sons, 5th Edition, 2000.
3. Askland, R.A., "The Science and Engineering of Materials", PWS-KENT Publishing Company, 2nd Edition, 1989.

ADVANCED WELDING TECHNOLOGY

VII Semester: MECH

Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME808	SKILL	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes:	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:		

OBJECTIVES:

The course should enable the students to:

I. Impart knowledge on various advanced welding processes and can apply them in engineering industry applications.
II. Understand the various principles required in advanced welding techniques.
III. Develop the knowledge on the design of welded joints and the quality control of weldments.

UNIT-I INTRODUCTION

Distortion- Methods to avoid distortion. Stresses in Joint Design Welding and Cladding of dissimilar materials - overlaying and surfacing Advanced welding techniques: TIG and MIG welding, Explosion Welding, Diffusion Welding, Friction welding, friction stir welding, linear friction welding, Thermit welding and under water welding.

UNIT -II INSPECTION OF WELDS

Destructive techniques like Tensile, Bend, Nick break, Impact & Hardness. Non-Destructive techniques like 'X' rays, Ultrasonic, Magnetic particle, Dye Penetrant, Gamma ray inspection.

UNIT -III ADVANCED WELDING TECHNIQUES

Advanced welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

UNIT -IV WELDING SYMBOLS

Welding Symbols- Need for symbols representing the welds, Basic weld symbols, Location of Weld, Supplementary symbols, Dimensions of welds, Examples Welding Design - Introduction, Principles of sound welding design, Welding joint design, Welding positions, Allowable strengths of welds-static/steady loads and dynamic loads

UNIT -V WELDING DESIGN

Design welds subjected to combined loads, Weld throat thickness, Problems Quality Control in Welding - Introduction, Quality assurance v/s Quality control, Weld quality, Discontinuities in welds, their causes and remedies and Quality conflicts.

Text Books:

1. John.K.C, "Metal Casting and Joining", PHI Publications, 2nd Edition, 2007.
2. Richard L Little, "Welding & Welding Technology", McGraw Hill Publications, 2nd Edition, 2001.
3. EdwardR. Bohnart, "Welding Principles and Practices", McGraw Hill Publications, 4th Edition, 2001.

Reference Books:

1. R. K. Jain, "Production Technology", Khanna Publishers, 18th Edition, 2013.
2. T. V. Ramana Rao, "Metal Casting", New Age, 1st Edition, 2010.
3. Philips Rosenthal, "Principles of Metal Castings", Tata McGraw Hill Publications, 2nd Edition, 2001.

VISION AND MISSION OF THE INSTITUTE

VISION

To bring forth professionally competent and socially sensitive engineers, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

B.TECH - PROGRAM OUTCOMES (POS)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**

PO-4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions **(Conduct Investigations of Complex Problems).**

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations **(Modern Tool Usage).**

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions **(Communication).**

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change **(Life-long learning).**

OBJECTIVES OF THE DEPARTMENT

DEPARTMENT OF MECHANICAL ENGINEERING

Programme Educational Objectives (PEO's)

A graduate of Institute of Aeronautical Engineering, Mechanical Engineering should enjoy a successful career in Mechanical Engineering or a related field after graduation. The program aims to:

PEO – I: To provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems.

PEO – II: To prepare students for successful careers in industry that meet the needs of local, Indian and multinational companies.

PEO – III: To develop the ability among students to synthesize data and technical concepts for application to product design and prepares students to work as part of teams on multidisciplinary projects.

PEO – IV: To promote student awareness for life-long learning and to introduce them to codes of professional practice, ethics and prepare them for higher studies.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO – I: To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.

PSO – II: An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.

PSO – III: To build the nation, by imparting technological inputs and managerial skills to become Technocrats.

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. **Who grants Autonomy? UGC, Govt., AICTE or University**
   In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2 **Shall IARE award its own Degrees?**
No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3 **What is the difference between a Deemed University and an Autonomy College?**
A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4 **How will the Foreign Universities or other stake – holders know that we are an Autonomous College?**
Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5 **What is the change of Status for Students and Teachers if we become Autonomous?**
An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6 **Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?**
There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7 **Will the students of IARE as an Autonomous College qualify for University Medals and Prizes for academic excellence?**
No. IARE has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8 **Can IARE have its own Convocation?**
No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9 **Can IARE give a provisional degree certificate?**
Since the examinations are conducted by IARE and the results are also declared by IARE, the college sends a list of successful candidates with their final Grades and Grade Point Averages including

CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10 Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11 What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12 Is it possible to have complete Internal Assessment for Theory or Practicals?

Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13 Why Credit based Grade System?

The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14 What exactly is a Credit based Grade System?

The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like A, B,C,D, etc. are assigned for a Range of Marks. (e.g. 91% and above is A+, 80 to 90 % could be A etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15 What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?

These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16 What is a Semester Grade Point Average (SGPA)?

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n}(C_i\, G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17 What is a Cumulative Grade Point Average (CGPA)?

An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{m} \left(C_j \, S_j \right) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester. CGPA is rounded to two decimal places.

18 Is there any Software available for calculating Grade point averages and converting the same into Grades?

Yes, The institute has its own MIS software for calculation of SGPA, CGPA, etc.

19 Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20 Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a make up Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21 How fast Syllabi can be and should be changed?

Autonomy allows us the freedom to change the syllabi as often as we need.

22 Will the Degree be awarded on the basis of only final year performance?

No. The CGPA will reflect the average performance of all the semester taken together.

23 What are Statutory Academic Bodies?

Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in every body is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24 Who takes Decisions on Academic matters?

The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Boared of Studies level are to be ratified at the Academic Council and Governing Body.

25 What is the role of Examination committee?

The Examinations Committee is responsible for the smooth conduct of internal, End Semester and make up Examinations. All matters involving the conduct of examinations spot valuations, tabulations preparation of Grade Cards etc fall within the duties of the Examination Committee.

26 Is there any mechanism for Grievance Redressal?

The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27 How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulation

28 Who declares the result?

The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29 Who will keep the Student Academic Records, University or IARE?

It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30 What is our relationship with the JNT University?

We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31 Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32 Shall we get autonomy for PG and Doctoral Programmes also?

Yes, presently our PG programmes also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculator, cell phone, pager, palm computer or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already

		appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

UNDERTAKING BY STUDENT / PARENT

"To make the students attend the classes regularly from the first day of starting of classes and be aware of the College regulations, the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the Dean, Academic".

I, Mr./Ms. -- joining I Semester / III Semester for the academic year 2016-2017 / 2017-2018 in Institute of Aeronautical Engineering, Hyderabad, do hereby undertake and abide by the following terms, and I will bring the ACKNOWLEDGEMENT duly signed by me and my parent and submit it to the Dean, Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/practical/drawing) and secure attendance of not less than 80% in every course as stipulated by Institute. I am fully aware that an attendance of less than 70% in more than three courses will make me lose one year.
3. I will compulsorily follow the dress code prescribed by the college.
4. I will conduct myself in a highly disciplined and decent manner both inside the classroom and on campus, failing which suitable action may be taken against me as per the rules and regulations of the institute.
5. I will concentrate on my studies without wasting time in the Campus/Hostel/Residence and attend all the tests to secure more than the minimum prescribed Class/Sessional Marks in each course. I will submit the assignments given in time to improve my performance.
6. I will not use Mobile Phone in the institute premises and also, I will not involve in any form of ragging inside or outside the campus. I am fully aware that using mobile phone to the institute premises is not permissible and involving in Ragging is an offence and punishable as per JNTUH/UGC rules and the law.
7. I declare that I shall not indulge in ragging, eve-teasing, smoking, consuming alcohol drug abuse or any other anti-social activity in the college premises, hostel, on educational tours, industrial visits or elsewhere.
8. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the Institution / authorities, failing which I will not be permitted to attend the classes.
9. I will not cause or involve in any sort of violence or disturbance both within and outside the college campus.
10. If I absent myself continuously for 3 days, my parents will have to meet the HOD concerned/ Principal.
11. I hereby acknowledge that I have received a copy of IARE - R16 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number