JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by State Act No. 30 of 2008)

Kukatpally, Hyderabad, Telangana (India).

ACADEMIC REGULATIONS FOR B.TECH. REGULAR STUDENTS

WITH EFFECT FROM

ACADEMIC YEAR 2016-17 (R-16)

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

1.1 JNTUH offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) at its non-autonomous constituent and affiliated colleges with effect from the academic year 2016-17 in the following branches of Engineering:

Branch
Civil Engineering
Electrical and Electronics Engineering
Mechanical Engineering
Electronics and Communication Engineering
Computer Science and Engineering
Chemical Engineering
Electronics and Instrumentation Engineering
Bio-Medical Engineering
Information Technology
Mechanical Engineering (Mechatronics)
Electronics and Telematics Engineering
Metallurgy and Material Technology
Electronics and Computer Engineering
Mechanical Engineering (Production)
Aeronautical Engineering
Instrumentation and Control Engineering
Biotechnology
Automobile Engineering
Mining Engineering
Petroleum Engineering
Civil and Environmental Engineering
Mechanical Engineering (Nano Technology)
Computer Science & Technology
Pharmaceutical Engineering

2.0 Eligibility for admission

2.1 Admission to the under graduate programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instructions for the entire under graduate programme in E&T will be **English** only.

3.0 B.Tech. Programme structure

3.1 A student after securing admission shall pursue the under graduate programme in B.Tech. in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course.

Each semester is structured to provide 24 credits, totaling to 192 credits for the entire B.Tech. programme.

Each student shall secure 192 credits (with CGPA ≥ 5) required for the completion of the under graduate programme and award of the B.Tech. degree.

3.2 **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 Semester scheme

Each under graduate programme is of 4 academic years (8 semesters) with the academic year being divided into two semesters of 22 weeks (≥ 90 instructional days) each, each semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and curriculum / course structure as suggested by AICTE are followed.

3.2.2 Credit courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for theory/ lecture (L) courses.
- One credit for two hours/ week/ semester for laboratory/ practical (P) courses or Tutorials (T).

Courses like Environmental Science, Professional Ethics, Gender Sensitization lab and other student activities like NCC/NSO and NSS are identified as mandatory courses. These courses will not carry any credits.

3.2.3 Subject Course Classification

All subjects/ courses offered for the under graduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The university has followed almost all the guidelines issued by AICTE/UGC.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes mathematics, physics and chemistry subjects
2		ES - Engineering Sciences	Includes fundamental engineering subjects
3		HS – Humanities and Social sciences	Includes subjects related to humanities, social sciences and management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. project or UG project or UG major project
8		Industrial training/ Mini- project	Industrial training/ Internship/ UG Mini-project/ Mini-project
9		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor courses	-	1 or 2 Credit courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory courses (non-credit)

4.0 Course registration

4.1 A ‘faculty advisor or counselor’ shall be assigned to a group of 15 students, who will advise student about the under graduate programme, its course structure and curriculum,

choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The on-line registration requests for any 'current semester' shall be **completed before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.

4.3 A student can apply for **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor/ counselor and the student.

4.4 A student may be permitted to register for the subjects/ courses of **choice** with a total of 24 credits per semester (minimum of 20 credits and maximum of 28 credits per semester and permitted deviation of ± 17%), based on **progress** and SGPA/ CGPA, and completion of the '**pre-requisites'** as indicated for various subjects/ courses, in the department course structure and syllabus contents. However, a **minimum** of 20 credits per semester must be registered to ensure the '**studentship**' in any semester.

4.5 Choice for '**additional subjects/ courses**' to reach the maximum permissible limit of 28 credits (above the typical 24 credit norm) must be clearly indicated, which needs the specific approval and signature of the faculty advisor/ counselor.

4.6 If the student submits ambiguous choices or multiple options or erroneous entries during **on-line** registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.

4.7 Subject/ course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the head of the department, with due notification and time-framed schedule, within the **first week** after the commencement of class-work for that semester.

4.8 Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor (subject to retaining a minimum of 20 credits), '**within a period of 15 days**' from the beginning of the current semester.

4.9 **Open electives**: The students have to choose one open elective (OE-I) during III year I semester, one (OE-II) during III year II semester, and one (OE-III) in IV year II semester, from the list of open electives given. However, the student cannot opt for an

open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

4.10 **Professional electives**: students have to choose professional elective (PE-I) in III year II semester, Professional electives II, III, and IV (PE-II, III and IV) in IV year I semester, Professional electives V, and VI (PE-V and VI) in IV year II semester, from the list of professional electives given. However, the students may opt for professional elective subjects offered in the related area.

5.0 **Subjects/ courses to be offered**

5.1 A typical section (or class) strength for each semester shall be 60.

5.2 A subject/ course may be offered to the students, **only if** a minimum of 20 students (1/3 of the section strength) opt for it. The maximum strength of a section is limited to 80 (60 + 1/3 of the section strength).

5.3 More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

5.4 If more entries for registration of a subject come into picture, then the Head of Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.

5.5 In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the '**parent department**'.

6.0 **Attendance requirements:**

6.1 A student shall be eligible to appear for the semester end examinations, if student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (excluding attendance in mandatory courses Environmental Science, Professional Ethics, Gender Sensitization Lab, NCC/NSO and NSS) for that semester.

6.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in **no** case be condoned.

6.5 **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester.** They may seek re-registration for all those subjects

registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.**6.**

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% marks (26 out of 75 marks) in the semester end examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to UG Mini Project and seminar, if student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student would be treated as failed, if student (i) does not submit a report on UG Mini Project, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required in the IV year I Semester, or (iii) secures less than 40% marks in industry UG Mini Project / seminar evaluations.

Student may reappear once for each of the above evaluations, when they are scheduled again; if student fails in such 'one reappearance' evaluation also, student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	**First year first semester to first year second semester**	**Regular course of study of first year first semester.**
2	**First year second semester to second year first semester**	**(i) Regular course of study of first year second semester.** **(ii) Must have secured at least 24 credits out of 48 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those**

		examinations or not.
3.	**Second year first semester to second year second semester**	**Regular course of study of second year first semester.**
4	**Second year second semester to third year first semester**	**(i) Regular course of study of second year second semester.** **(ii) Must have secured at least 58 credits out of 96 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
5	**Third year first semester to third year second semester**	**Regular course of study of third year first semester.**
6	**Third year second semester to fourth year first semester**	**(i) Regular course of study of third year second semester.** **(ii) Must have secured at least 86 credits out of 144 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
7	**Fourth year first semester to fourth year second semester**	**Regular course of study of fourth year first semester.**

7.4 A student shall register for all subjects covering 192 credits as specified and listed in the course structure, fulfills all the attendance and academic requirements for 192 credits, 'earn all 192 credits by securing SGPA ≥ 5.0 (in each semester), and CGPA (at the end of each successive semester) ≥ 5.0, to successfully complete the under graduate programme.

7.5 After securing the necessary 192 credits as specified for the successful completion of the entire under graduate programme, the student can avail exemption of two subjects up to 6 credits, that is, one open elective and one professional elective subject or two professional elective subjects for optional drop out from these 192 credits earned; resulting in 186 credits for under graduate programme performance evaluation, i.e., the performance of the student in these 186 credits shall alone be taken into account for the calculation of 'the final CGPA (at the end of under graduate programme, which takes the SGPA of the IV year II semester into account)' , and shall be

indicated in the grade card of IV year II semester. However, the performance of student in the earlier individual semesters, with the corresponding SGPA and CGPA for which grade cards have already been given will not be altered.

7.6 If a student registers for some more '**extra subjects'** (in the parent department or other departments/branches of engg.) other than those listed subjects totaling to 192 credits as specified in the course structure of his department, the performances in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 192 credits) will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects'** registered, % of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1 – 7.5 above.

7.7 A student eligible to appear in the end semester examination for any subject/ course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.8 A student **detained in a semester due to shortage of attendance may be re-admitted when the same semester is offered in the next academic year for fulfillment of academic requirements**. The academic regulations under which student has been readmitted shall be applicable. However, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which student has been detained.

7.9 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which student has been readmitted shall be applicable to him.

8.0 Evaluation - Distribution and Weightage of marks

8.1 The performance of a student in every subject/course (including practicals and UG major project) will be evaluated for 100 marks each, with 25 marks allotted for CIE (Continuous Internal Evaluation) and 75 marks for SEE (Semester End-Examination).

8.2 For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of one objective paper, one descriptive paper and one assignment. The objective paper and the descriptive paper shall be for 10 marks each with a total duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for descriptive paper). The objective paper is set with 20 bits of multiple choice, fill-in the blanks and matching type of questions for a total of 10 marks. The descriptive paper shall contain 4 full questions out of which, the student has to answer 2 questions, each carrying 5 marks. While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Five marks are allocated for

assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-examination, and the second assignment should be submitted before the conduct of the second mid-examination. The total marks secured by the student in each mid-term examination are evaluated for 25 marks, and the average of the two mid-term examinations shall be taken as the final marks secured by each student in internals/sessionals. If any student is absent from any subject of a mid-term examination, an on-line test will be conducted for him by the university. The details of the question paper pattern are as follows,

- The end semester examinations will be conducted for 75 marks consisting of two parts viz. i) **Part- A** for 25 marks, ii) **Part - B** for 50 marks.
- Part-A is compulsory question which consists of ten sub-questions. The first five sub-questions are from each unit and carry 2 marks each. The next five sub-questions are one from each unit and carry 3 marks each.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

8.3 For practical subjects there shall be a continuous internal evaluation during the semester for 25 sessional marks and 75 semester end examination marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. The semester end examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the clusters of colleges which are decided by the examination branch of the university.

8.4 For the subject having design and/or drawing, (such as engineering graphics, engineering drawing, machine drawing) and estimation, the distribution shall be 25 marks for continuous internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for semester end examination. There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for internal tests.

8.5 There shall be an UG mini-project, in collaboration with an industry of their specialization. Students will register for this immediately after III year II semester examinations and pursue it during summer vacation. The UG mini-project shall be submitted in a report form and presented before the committee in IV year I semester. It shall be evaluated for 100 marks. The committee consists of an external examiner, Head of the Department, supervisor of the UG mini-project and a senior faculty member of the department. There shall be no internal marks for UG mini-project.

8.6 There shall be a seminar presentation in IV year I semester. For the seminar, the student shall collect the information on a specialized topic, prepare a technical report, and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 100 marks. There shall be no semester end examination for the seminar.

8.7 Out of a total of 100 marks for the UG major Project, 25 marks shall be allotted for internal evaluation and 75 marks for the end semester examination (viva voce). The end semester examination of the UG major Project shall be conducted by the same committee as appointed for the UG mini-project. In addition, the UG major Project supervisor shall also be included in the committee. The topics for UG mini project, seminar and UG major Project shall be different from one another. The evaluation of UG major Project shall be made at the end of IV year II semester. The internal evaluation shall be on the basis of two seminars given by each student on the topic of UG major Project.

8.8 The laboratory marks and the sessional marks awarded by the college are subject to scrutiny and scaling by the university wherever necessary. In such cases, the sessional and laboratory marks awarded by the college will be referred to a committee. The committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective institutions as per the university rules and produced before the committees of the university as and when asked for.

8.9 For mandatory courses Environmental Science, Professional Ethics and gender sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the subject/course.

8.10 For mandatory courses NCC/ NSO and NSS, a 'satisfactory participation certificate' shall be issued to the student from the authorities concerned, only after securing ≥ 65% attendance in such a course.

8.11 No marks or letter grade shall be allotted for all mandatory/non-credit courses.

9.0 Grading procedure

9.1 Marks will be awarded to indicate the performance of student in each theory subject, labaratory / practicals, seminar, UG mini project, UG major project. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the performance of student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	**O (Outstanding)**	**10**
80 and less than 90%	**A^+ (Excellent)**	**9**
70 and less than 80%	**A (Very Good)**	**8**
60 and less than 70%	**B^+ (Good)**	**7**
50 and less than 60%	**B (Average)**	**6**
40 and less than 50%	**C (Pass)**	**5**
Below 40%	**F (FAIL)**	**0**
Absent	**Ab**	**0**

9.3 A student obtaining '**F**' grade in any subject shall be deemed to have '**failed**' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4 A student who has not appeared for examination in any subject, '**Ab**' grade will be allocated in that subject, and student shall be considered '**failed**'. Student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered.

9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6 A student earns grade point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'credit points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit points (CP) = grade point (GP) x credits …. For a course

9.7 The student passes the subject/ course only when **GP ≥ 5 ('C' grade or above)**

9.8 The semester grade point average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects/ courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\textbf{SGPA} = \{ \textstyle\sum_{i=1}^{N} C_i\, G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ …. For each semester,}$$

where ‘i’ is the subject indicator index (takes into account all subjects in a semester), ‘N’ is the no. of subjects ‘**registered’** for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the ith subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that ith subject.

9.9 The cumulative grade point average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\textbf{CGPA} = \{ \sum_{j=1}^{M} C_j \, G_j \} / \{ \sum_{j=1}^{M} C_j \} \ \ldots \text{ for all S semesters registered}$$

(i.e., up to and inclusive of S semesters, S ≥ 2),

where ‘**M’** is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has ‘**registered’** i.e., from the 1st semester onwards up to and inclusive of the 8th semester, ‘j’ is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the jth subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that jth subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

SGPA = 152/21 = 7.23

Illustration of calculation of CGPA:

Semester	Credits	SGPA	Credits x

			SGPA
Semester I	24	7	24 x 7 = 168
Semester II	24	6	24 x 6 = 144
Semester III	24	6.5	24 x 6.5 = 156
Semester IV	24	6	24 x 6 = 144
Semester V	24	7.5	24 x 7.5 = 180
Semester VI	24	8	24 x 8 = 192
Semester VII	24	8.5	24 x 8.5 = 204
Semester VIII	24	8	24 x 8 = 192
	192		1380

CGPA = 1380/192 = 7.18

9.10 For merit ranking or comparison purposes or any other listing, **only** the '**rounded off'** values of the CGPAs will be used.

9.11 For calculations listed in regulations 9.6 to 9.9, performance in failed subjects/ courses (securing **F** grade) will also be taken into account, and the credits of such subjects/ courses will also be included in the multiplications and summations. After passing the failed subject(s) newly secured letter grades will be taken into account for calculation of SGPA and CGPA. However, mandatory courses will not be taken into consideration.

10.0 Passing standards

10.1 A student shall be declared successful or 'passed' in a semester, if student secures a GP ≥ 5 ('C' grade or above) in every subject/course in that semester (i.e. when student gets an SGPA ≥ 5.00 at the end of that particular semester); and a student shall be declared successful or 'passed' in the entire under graduate programme, only when gets a CGPA ≥ 5.00 for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, and grade earned etc.), credits earned, SGPA, and CGPA.

11.0 Declaration of results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

% of Marks = (final CGPA – 0.5) x 10

12.0 Award of degree

12.1 A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 192 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified'** for the award of the B.Tech. degree in the chosen branch of Engineering as selected at the time of admission.

12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 Students with final CGPA (at the end of the under graduate programme) ≥ 8.00, and fulfilling the following conditions -

(i) Should have passed all the subjects/courses in '**first appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should have secured a CGPA ≥ 8.00, at the end of each of the 8 sequential semesters, starting from I year I semester onwards.

(iii) Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason, shall be placed in '**first class with distinction'**.

12.4 Students with final CGPA (at the end of the under graduate programme) ≥ 6.50 but < 8.00, shall be placed in '**first class'**.

12.5 Students with final CGPA (at the end of the under graduate programme) ≥ 5.50 but < 6.50, shall be placed in '**second class'**.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the under graduate programme) ≥ 5.00 but < 5.50, shall be placed in '**pass class**'.

12.7 A student with final CGPA (at the end of the under graduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**university rank**' and '**gold medal**'.

13.0 Withholding of results

13.1 If the student has not paid the fees to the university/ college at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory regulations

A. **For students detained due to shortage of attendance**:

1. A Student who has been detained in I year of R09/R13/R15 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R16 Regulations and he is required to complete the study of B.Tech./B. Pharmacy programme within the stipulated period of eight academic years from the date of first admission in I Year.

2. A student who has been detained in any semester of II, III and IV years of R09/R13/R15 regulations for want of attendance, shall be permitted to join the corresponding semester of R16 regulations and is required to complete the study of B.Tech./B. Pharmacy within the stipulated period of eight academic years from the date of first admission in I Year. The R16 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester.

   See rule (C) for further Transitory Regulations.

B. **For students detained due to shortage of credits**:

3. A student of R09/R13/R15 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R16 Regulations only after acquiring the required credits as per the corresponding regulations of his/her first admission. The student is required to complete the study of B.Tech./B. Pharmacy within the stipulated period of eight academic years from the year of first admission. The R16 Academic Regulations are applicable to a student from the year of readmission onwards.

   See rule (C) for further Transitory Regulations.

C. **For readmitted students in R16 Regulations**:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.

5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R16 Regulations. The performance evaluation of the student will be done after the exemption of two subjects if total credits acquired are ≤ 206, three subjects if total credits acquired are > 206 (see R16 Regulations for exemption details).

6. If a student readmitted to R16 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R16 Regulations will be substituted by another subject to be suggested by the University.

Note: If a student readmitted to R16 Regulations, has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R16 Regulations, the College Principals concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

15.0 Student transfers

15.1 There shall be no branch transfers after the completion of admission process.

15.2 There shall be no transfers from one college/stream to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.

15.3 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JNTUH, the students have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.

15.4 The transferred students from other Universities/institutions to JNTUH affiliated colleges who are on rolls to be provide one chance to write the CBT (internal marks) in the **failed subjects and/or subjects not studied** as per the clearance letter issued by the university.

15.5 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the **failed subjects and/or subjects not studied,** to the students transferred from other universities/institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

16.0 Scope

16.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

16.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the vice-chancellor is final.

16.3 The university may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the university authorities.

Academic Regulations for B.Tech. (Lateral Entry Scheme) from the AY 2017-18

1. **Eligibility for award of B. Tech. Degree (LES)**

   The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 144 credits and secure 144 credits with CGPA ≥ 5 from II year to IV year B.Tech. programme (LES) for the award of B.Tech. degree. **Out of the 144 credits secured, the student can avail exemption up to 6 credits**, that is, one open elective subject and one professional elective subject or two professional elective subjects resulting in 138 credits for B.Tech programme performance evaluation**.**

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

5. **Promotion rule**

S. No	Promotion	Conditions to be fulfilled
1	**Second year first semester to second year second semester**	**Regular course of study of second year first semester.**
2	**Second year second semester to third year first semester**	**(i) Regular course of study of second year second semester.** **(ii) Must have secured at least 29 credits out of 48 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
3	**Third year first semester to third year second semester**	**Regular course of study of third year first semester.**
4	**Third year second semester to fourth year first semester**	**(i) Regular course of study of third year second semester.** **(ii) Must have secured at least 58 credits out of 96 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary**

		examinations, whether the student takes those examinations or not.
5	**Fourth year first semester to fourth year second semester**	**Regular course of study of fourth year first semester.**

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student 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 student orally or by any other body language methods or communicates through cell phones with any student 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 students 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 student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student 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 student is to be cancelled and sent to the university.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student 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 student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student 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 student 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 student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student 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 chief superintendent/assistant – superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around 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 student(s) has (have) already appeared and shall not be

	hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge 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 officer-in-charge, 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 college campus 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.	permitted to appear for the remaining examinations of the subjects of that semester/year. The students 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 of 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 student 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 student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student 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 student 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 student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or	Student of the colleges expulsion from the examination hall and cancellation of the

	any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	performance in that subject and all other subjects the student 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 student 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 student 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 student 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.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   a. A show cause notice shall be issued to the college.
   b. Impose a suitable fine on the college.
   c. Shifting the examination centre from the college to another college for a specific period of not less than one year.

* * * * *

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.TECH I YEAR COURSE STRUCTURE AND SYLLABUS (R16)

(Common for EEE, ECE, CSE, EIE, BME, IT, ETE, ECM, ICE)

Applicable From 2017-18 Admitted Batch

I YEAR I SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	MA101BS	Mathematics-I	3	1	0	3
2	CH102BS	Engineering Chemistry	4	0	0	4
3	PH103BS	Engineering Physics-I	3	0	0	3
4	EN104HS	Professional Communication in English	3	0	0	3
5	ME105ES	Engineering Mechanics	3	0	0	3
6	EE106ES	Basic Electrical and Electronics Engineering	4	0	0	4
7	EN107HS	English Language Communication Skills Lab	0	0	3	2
8	ME108ES	Engineering Workshop	0	0	3	2
9	*EA109MC	NSS	0	0	0	0
		Total Credits	**20**	**1**	**6**	**24**

I YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	PH201BS	Engineering Physics-II	3	0	0	3
2	MA202BS	Mathematics-II	4	1	0	4
3	MA203BS	Mathematics-III	4	1	0	4
4	CS204ES	Computer Programming in C	3	0	0	3
5	ME205ES	Engineering Graphics	2	0	4	4
6	CH206BS	Engineering Chemistry Lab	0	0	3	2
7	PH207BS	Engineering Physics Lab	0	0	3	2
8	CS208ES	Computer Programming in C Lab	0	0	3	2
9	*EA209MC	NCC/NSO	0	0	0	0
		Total Credits	**16**	**2**	**13**	**24**

***Mandatory Course – Satisfactory/Unsatisfactory.**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING
II, III, IV YEARS COURSE STRUCTURE & SYLLABUS (R16)

Applicable From 2016-17 Admitted Batch

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA301BS	Mathamatics – IV	4	1	0	4
2	EE302ES	Electromagnetic Fields	4	1	0	4
3	EE303ES	Electrical Machines-I	4	1	0	4
4	EE304ES	Network Theory	3	0	0	3
5	EE305ES	Electronic Circuits	3	0	0	3
6	EE306ES	Electrical Machines Lab - I	0	0	3	2
7	EC306ES	Electronic Devices & Circuits Lab	0	0	3	2
8	EE307ES	Networks Lab	0	0	3	2
9	*MC300ES	Environmental Science and Technology	3	0	0	0
		Total Credits	**21**	**3**	**9**	**24**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EC401ES	Switching Theory & Logic Design	3	1	0	3
2	EE402ES	Power Systems - I	4	1	0	4
3	EE403ES	Electrical Machines – II	4	1	0	4
4	EE404ES	Control Systems	4	1	0	4
5	SM405MS	Business Economics and Financial Analysis	3	0	0	3
6	EE406ES	Control Systems Lab	0	0	3	2
7	EE407ES	Electrical Machines Lab - II	0	0	3	2
8	EE408ES	Electronic Circuits Lab	0	0	3	2
9	*MC400HS	Gender Sensitization Lab	0	0	3	0
		Total Credits	**18**	**4**	**12**	**24**

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EE501PC	Electrical Measurements & Instrumentation	4	1	0	4
2	EE502PC	Power Systems - II	4	1	0	4
3	EI503PC	Microprocessors and Microcontrollers	4	1	0	4
4	SM504MS	Fundamentals of Management	3	0	0	3
5		Open Elective - I	3	0	0	3
6	EE505PC	Electrical Measurements & Instrumentation Lab	0	0	3	2
7	EE506PC	Basic Electrical simulation Lab	0	0	3	2
8	EI507PC	Microprocessors and Microcontrollers Lab	0	0	3	2
9	*MC500HS	Professional Ethics	3	0	0	0
		Total Credits	**21**	**3**	**9**	**24**

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EE601PC	Power Systems Analysis	4	1	0	4
2	EE602PC	Power Electronics	4	1	0	4
3	EE603PC	Switch Gear and Protection	4	1	0	4
4		Open Elective - II	3	0	0	3
5		Professional Elective - I	3	0	0	3
6	EE604PC	Power Systems Lab	0	0	3	2
7	EE605PC	Power Electronics Lab	0	0	3	2
8	EN606HS	Advanced English Communication Skills Lab	0	0	3	2
		Total Credits	**18**	**3**	**9**	**24**

During Summer Vacation between III and IV Years: Industry Oriented Mini Project

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EE701PC	Power Semiconductor Drives	4	1	0	4
2	EE702PC	Power System Operation and control	4	1	0	4
3		Professional Elective - II	3	0	0	3
4		Professional Elective - III	3	0	0	3
5		Professional Elective - IV	3	0	0	3
6	EE703PC	Electrical Systems Simulation Lab	0	0	3	2

7	EE704PC	Electrical Workshop	0	0	3	2
8	EE705PC	Industry Oriented Mini Project	0	0	3	2
9	EE706PC	Seminar	0	0	2	1
		Total Credits	**17**	**2**	**11**	**24**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Open Elective - III	3	0	0	3
2		Professional Elective-V	3	0	0	3
3		Professional Elective-VI	3	0	0	3
4	EE801PC	Major Project	0	0	30	15
		Total Credits	**9**	**0**	**30**	**24**

Professional Elective - I (PE - I):

EM611PE	Computer Organization
EE612PE	Linear Systems Analysis
EE613PE	Linear and Digital IC Applications
EE614PE	Electrical and Electronics Instrumentation

Professional Elective - II (PE - II):

EE721PE	Digital Signal Processing
EE722PE	HVDC Transmission
ET721PE	Switch Mode Power Supplies
EE724PE	Reliability Engineering

Professional Elective - III (PE - III):

EE731PE	Digital Control Systems
EE732PE	Power Quality
EE733PE	Modern Power Electronics
EE734PE	Optimization Techniques

Professional Elective - IV (PE-IV):

EE741PE	Programmable Logic Controllers
EE742PE	EHV AC Transmission Systems
EE743PE	Flexible A.C. Transmission Systems
EE744PE	Special Machines

Professional Elective - V (PE-V):

EE851PE	Artificial Neural Networks and Fuzzy Systems
EE852PE	Electrical Distribution Systems

EE853PE	Wind, Solar and Hybrid Energy Systems
EE854PE	High Voltage Engineering

Professional Elective - VI (PE-VI):

EE861PE	VLSI Design
EE862PE	Smart Electric Grid
EE863PE	Utilization of Electric Power
EE864PE	Electric and Hybrid Vehicles

***Open Elective** subjects' syllabus is provided in a separate document.

***Open Elective** – Students should take Open Electives from the List of Open Electives Offered by Other Departments/Branches Only.

Ex: - A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
LIST OF OPEN ELECTIVES OFFERED BY VARIOUS DEPARTMENTS FOR B.TECH. III AND IV YEARS

S. No.	Name of the Department Offering Open Electives	Open Elective – I (Semester – V)	Open Elective – II (Semester – VI)
1	Aeronautical Engg.	AE511OE: Introduction to Space Technology	AE621OE: Introduction to Aerospace Engineering
2	Automobile Engg.	CE511OE: Disaster Management MT512OE: Intellectual Property Rights	MT621OE: Data Structures MT622OE: Artificial Neural Networks
3	Biomedical Engg.	BM511OE: Reliability Engineering	BM621OE: Medical Electronics
4	Civil Engg.	CE511OE: Disaster Management.	CE621OE: Remote Sensing and GIS CE622OE: Geo-Informatics CE623OE: Intellectual Property Rights
5	Civil and Environmental Engg.	CE511OE: Disaster Management	CN621OE: Environmental Impact Assessment CE623OE: Intellectual Property Rights
6	Computer Science and Engg. / Information Technology	CS511OE: Operating Systems CS512OE: Database Management Systems	CS621OE: Java Programming CS622OE: Software Testing Methodologies CS623OE: Cyber Security
7	Electronics and Communication Engg. / Electronics and Telematics Engg.	EC511OE: Principles of Electronic Communications	EC621OE: Principles of Computer Communications and Networks
8	Electronics and Computer Engg.	EM511OE: Scripting Languages	EM621OE: Soft Computing Techniques
9	Electrical and Electronics Engg.	EE511OE: Non-Conventional Power Generation EE512OE: Electrical Engineering Materials EE513OE: Nanotechnology	EE621OE: Design Estimation and Costing of Electrical Systems EE622OE: Energy Storage Systems EE623OE: Introduction to Mechatronics
10	Electronics and Instrumentation Engg.	EI511OE: Electronic Measurements and Instrumentation	EI621OE: Industrial Electronics
11	Mechanical Engg.	ME511OE: Optimization Techniques ME512OE: Computer Graphics	ME621OE: World Class Manufacturing ME622OE: Fundamentals of Robotics

		ME513OE: Introduction to Mechatronics ME514OE: Fundamentals of Mechanical Engineering	ME623OE: Fabrication Processes
12	Mechanical Engg. (Material Science and Nanotechnology)	NT511OE: Fabrication Processes NT512OE: Non destructive Testing Methods NT513OE: Fundamentals of Engineering Materials	NT621OE: Introduction to Material Handling NT622OE: Non-Conventional Energy Sources NT623OE: Robotics
13	Mechanical Engg. (mechatronics)	MT511OE: Analog and Digital I.C. Applications MT512OE: Intellectual Property Rights MT513OE: Computer Organization	MT621OE: Data Structures MT622OE: Artificial Neural Networks MT623OE: Industrial Management
14	Metallurgical and Materials Engg.	MM511OE: Materials Characterization Techniques	MM621OE: Science and Technology of Nano Materials MM622OE: Metallurgy of Non Metallurgists
15	Mining Engg.	MN511OE: Introduction to Mining Technology	MN621OE: Coal Gasification, Coal Bed Methane and Shale Gas
16	Petroleum Engg.	PE511OE: Materials Science and Engineering PE512OE: Renewable Energy Sources PE513OE: Environmental Engineering	PE621OE: Energy Management and Conservation PE622OE: Optimization Techniques PE623OE: Entrepreneurship and Small Business Enterprises

S. No.	Name of the Department Offering Open Electives	Open Elective –III (Semester – VIII)
1	Aeronautical Engg.	AE831OE: Air Transportation Systems AE832OE: Rockets and Missiles
2	Automobile Engg.	AM831OE: Introduction to Mechatronics AM832OE: Microprocessors and Microcontrollers
3	Biomedical Engg.	BM831OE: Telemetry and Telecontrol BM832OE: Electromagnetic Interference and Compatibility
4	Civil Engg.	CE831OE: Environmental Impact Assessment CE832OE: Optimization Techniques in Engineering CE833OE: Entrepreneurship and Small Business Enterprises

5	Civil and Environmental Engg.	CN831OE: Remote Sensing and GIS CE833OE: Entrepreneurship and Small Business Enterprises
6	Computer Science and Engg. / Information Technology	CS831OE: Linux Programming CS832OE: R Programming CS833OE: PHP Programming
7	Electronics and Communication Engg. / Electronics and Telematics Engg.	EC831OE: Electronic Measuring Instruments
8	Electronics and Computer Engg.	EM831OE: Data Analytics
9	Electrical and Electronics Engg.	EE831OE: Entrepreneur Resource Planning EE832OE: Management Information Systems EE833OE: Organizational Behaviour
10	Electronics and Instrumentation Engg.	EI831OE: Sensors and Transducers, EI832OE: PC Based Instrumentation
11	Mechanical Engg.	ME831OE: Total Quality Management ME832OE: Industrial Safety, Health, and Environmental Engineering ME833OE: Basics of Thermodynamics ME834OE: Reliability Engineering
12	Mechanical Engg. (Material Science and Nanotechnology)	NT831OE: Concepts of Nano Science And Technology NT832OE: Synthesis of Nanomaterials NT833OE: Characterization of Nanomaterials
13	Mechanical Engg. (mechatronics)	MT831OE: Renewable Energy Sources MT832OE: Production Planning and Control CE833OE: Entrepreneurship and Small Business Enterprises
14	Metallurgical and Materials Engg.	MM831OE: Design and Selection of Engineering Materials
15	Mining Engg.	MN831OE: Solid Fuel Technology MN832OE: Health & Safety in Mines
16	Petroleum Engg.	PE831OE: Disaster Management PE832OE: Fundamentals of Liquefied Natural Gas PE833OE: Health, Safety and Environment in Petroleum Industry

***Open Elective –** Students should take Open Electives from List of Open Electives Offered by Other Departments/Branches Only.

Ex: - A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.

MATHEMATICS- I
(Linear Algebra and Differential Equations)

B.Tech. I Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **MA101BS**	**3**	**1/0/0**	**3**

Prerequisites: Foundation course (No prerequisites)**.**

Course Objectives: To learn

- types of matrices and their properties
- the concept of rank of a matrix and applying the same to understand the consistency
- solving the linear systems
- the concepts of eigen values and eigen vectors and reducing the quadratic forms into their canonical forms
- partial differentiation, concept of total derivative
- finding maxima and minima of functions of two variables
- methods of solving the linear differential equations of first and higher order
- the applications of the differential equations
- formation of the partial differential equations and solving the first order equations.

Course Outcomes: After learning the contents of this paper the student must be able to

- write the matrix representation of a set of linear equations and to analyze the solution of the system of equations
- find the Eigen values and Eigen vectors which come across under linear transformations
- find the extreme values of functions of two variables with/ without constraints.
- identify whether the given first order DE is exact or not
- solve higher order DE's and apply them for solving some real world problems

UNIT–I

Initial Value Problems and Applications

Exact differential equations - Reducible to exact.

Linear differential equations of higher order with constant coefficients: Non homogeneous terms with RHS term of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax}V(x), xV(x)- Operator form of the differential equation, finding particular integral using inverse operator, Wronskian of functions, method of variation of parameters.

Applications: Newton's law of cooling, law of natural growth and decay, orthogonal trajectories, Electrical circuits.

UNIT–II

Linear Systems of Equations

Types of real matrices and complex matrices, rank, echelon form, normal form, consistency and solution of linear systems (homogeneous and Non-homogeneous) - Gauss elimination,

Gauss Jordon and LU decomposition methods- Applications: Finding current in the electrical circuits.

UNIT–III

Eigen values, Eigen Vectors and Quadratic Forms

Eigen values, Eigen vectors and their properties, Cayley - Hamilton theorem (without proof), Inverse and powers of a matrix using Cayley - Hamilton theorem, Diagonalization, Quadratic forms, Reduction of Quadratic forms into their canonical form, rank and nature of the Quadratic forms – Index and signature.

UNIT–IV

Partial Differentiation

Introduction of partial differentiation, homogeneous function, Euler's theorem, total derivative, Chain rule, Taylor's and Mclaurin's series expansion of functions of two variables, functional dependence, Jacobian.

Applications: maxima and minima of functions of two variables without constraints and Lagrange's method (with constraints)

UNIT-V

First Order Partial Differential Equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, Lagranges method to solve the first order linear equations and the standard type methods to solve the non linear equations.

Text Books:

1. A first course in differential equations with modeling applications by Dennis G. Zill, Cengage Learning publishers.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.

References:

1. Advanced Engineering Mathematics by E. Kreyszig, John Wiley and Sons Publisher.
2. Engineering Mathematics by N. P. Bali, Lakshmi Publications.

ENGINEERING CHEMISTRY

B.Tech. I Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **CH102BS/CH202BS**	**4**	**0/0/0**	**4**

Course Objectives:

1) To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
2) To include the importance of water in industrial usage, significance of corrosion control to protect the structures, polymers and their controlled usage.
3) To acquire knowledge of engineering materials and about fuels and batteries.
4) To acquire required knowledge about engineering materials like cement, refractories and composites.

Course Outcomes:

Students will gain the basic knowledge of electrochemical procedures related to corrosion and its control. They can understand the basic properties of water and its usage in domestic and industrial purposes. They learn the use of fundamental principles to make predictions about the general properties of materials. They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

UNIT- I

Water and its treatment: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness – Estimation of hardness of water by complexometric method. Numerical problems. Potable water and its specifications- Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and Ozonization. Defluoridation – Nalgonda technique - Determination of F^- ion by ion- selective electrode method.

Boiler troubles:

Sludges, scales and Caustic embrittlement. Internal treatment of Boiler feed water – Calgon conditioning – Phosphate conditioning - Colloidal conditioning – Softening of water by ion-exchange processes. Desalination of water – Reverse osmosis. Numerical problems – Sewage water - Steps involved in treatment of sewage.

UNIT-II

Electrochemistry and Batteries:

Electrochemistry: Electrode- electrode potential, standard electrode potential, types of electrodes – Construction and functioning of Standard hydrogen electrode, calomel and glass electrode. Nernst equation - electrochemical series and its applications. Electrochemical cells: Daniel cell – cell notation, cell reaction and cell emf -– Concept of concentration cells – Electrolyte concentration cell –Numerical problems.

Batteries: Cell and battery - Primary battery (dry cell, alkaline cell and Lithium cell) and Secondary battery (lead acid, Ni-Cd and lithium ion cell),
Fuel cells: Hydrogen –oxygen and methanol-oxygen fuel cells – Applications.

UNIT-III
Polymers: Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples.
Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, compounding and fabrication of plastics (compression and injection moulding). Preparation, Properties and engineering applications of PVC and Bakelite.
Fibers: Characteristics of fibers – preparation, properties and applications of Nylon-6, 6 and Dacron. Fiber reinforced plastics (FRP) – Applications.
Rubbers: Natural rubber and its vulcanization - compounding of rubber.
Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.
Conducting polymers: Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.
Biodegradable polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

UNIT-IV
Fuels and Combustion: Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking – types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG.
Combustion: Definition, Calorific value of fuel – HCV, LCV; Calculation of air quantity required for combustion of a fuel.

UNIT-V
Cement, Refractories, Lubricants and Composites:
Cement: Portland cement, its composition, setting and hardening of Portland cement.
Special cements: White cement, water proof cement, High alumina cement and Acid resistant cement.
Refractories: Classification, characteristics of good refractories, Refractoriness, refractoriness under load, porosity and chemical inertness – applications of refractories.
Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.
Composites: Introduction- Constituents of composites – advantages, classification and constituents of composites. Applications of composites.

Text books:

1) Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, New Delhi (2010)
2) Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, New Delhi. (2016)

Reference Books:

1) Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
2) Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)
3) Engineering Chemistry by Thirumala Chary and Laxminarayana, Scitech Publishers, Chennai (2016).

ENGINEERING PHYSICS/ENGINEERING PHYSICS - I

B.Tech. I Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **PH103BS**	**3**	**0/0/0**	**3**

Course Objectives:

- To understand interaction of light with matter through interference, diffraction and polarization.
- To able to distinguish ordinary light with a laser light and to realize propagation of light through optical fibers.
- To understand various crystal systems and there structures elaborately.
- To study various crystal imperfections and probing methods like X-RD.

Course outcomes: after completion of this course the student is able to

- Realize the importance of light phenomena in thin films and resolution.
- Learn principle, working of various laser systems and light propagation through optical fibers.
- Distinguish various crystal systems and understand atomic packing factor.
- Know the various defects in crystals.

UNIT-I

Interference: Coherence, division of amplitude and division of wave front, interference in thin films (transmitted and reflected light), Newton's rings experiment.

Diffraction: Distinction between Fresnel and Fraunhoffer diffraction, diffraction due to single slit, N-slits, Diffraction grating experiment.

UNIT-II

Polarization: Introduction, Malus's law, double refraction, Nicol prism, Quarter wave and half wave plates.

Lasers: Characteristics of lasers, spontaneous and stimulated emission of radiation, Einstein coefficients, population inversion, ruby laser, helium – neon laser, semi conductor laser, applications of lasers

UNIT-III

Fiber Optics: Principle of optical fiber, construction of fiber, acceptance angle and acceptance cone, numerical aperture, types of optical fibers: step index and graded index fibers, attenuation in optical fibers, applications of optical fibers in medicine and sensors**.**

UNIT-IV

Crystallography: Space lattice, unit cell and lattice parameters, crystal systems, Bravais lattices, atomic radius, co-ordination number and packing factor of SC, BCC, FCC, HCP and

diamond, Miller indices, crystal planes and directions, inter planar spacing of orthogonal crystal systems.

UNIT-V

X-ray Diffraction and Defects in Crystals: Bragg's law, X-ray diffraction methods: Laue method, powder method; point defects: vacancies, substitutional, interstitial, Frenkel and Schottky defects, line defects (qualitative) and Burger's vector, surface defects: stacking faults, twin, tilt and grain boundaries.

Text Books:

1. Physics Vol. 2, Halliday, Resnick and Kramer John wiley and Sons, Edition 4.
2. Modern Engineering Physics, K. Vijaya Kumar and S. Chandra Lingam, S. Chand and Co. Pvt. Ltd.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Student edition.

Reference Books:

1. X-Ray Crystallography, Phillips, John Wiley publishers.
2. Waves, Frank S Crawford Jr, Berkeley Physics course, Volume 3.
3. Solid State Physics, AJ Dekker, MacMilan Publishers.
4. Introduction to Crystallography, Phillips, John Wiley publishers.

PROFESSIONAL COMMUNICATION IN ENGLISH

B.Tech. I Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **EN104HS/EN204HS**	**3**	**0/0/0**	**3**

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic and communicative competencies of Engineering students.

In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text book for detailed study. The students should be encouraged to read the texts/poems silently leading to reading comprehension. Reading comprehension passages are given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, from newspaper articles, advertisements, promotional material, etc. *The focus in this syllabus is on skill development, fostering ideas and practice of language skills.*

Course Objectives: The course will help students to:

a. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
b. Equip students to study academic subjects more effectively using the theoretical and Practical components of English syllabus.
c. Develop study skills and communication skills in formal and informal situations.

Course Outcomes: Students will be able to:

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in formal and informal contexts.

SYLLABUS

Reading Skills:

Objectives:

1. To develop an awareness in students about the significance of silent reading and comprehension.
2. To develop students' ability to guess meanings of words from the context and grasp the overall message of the text, draw inferences, etc., by way of:

- Skimming and Scanning the text
- Intensive and Extensive Reading
- Reading for Pleasure
- Identifying the topic sentence

- Inferring lexical and contextual meaning
- Recognizing Coherence/Sequencing of Sentences

NOTE: The students will be trained in reading skills using the prescribed texts for detailed study. They will be tested in reading comprehension of different 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.

Writing Skills:
Objectives:

1. To develop an awareness in the students about writing as an exact and formal skill
2. To create an awareness in students about the components of different forms of writing, beginning with the lower order ones through;
   • Writing of sentences
   • Use of appropriate vocabulary
   • Paragraph writing
   • Coherence and cohesiveness
   • Narration / description
   • Note Making
   • Formal and informal letter writing
   • Describing graphs using expressions of comparison

In order to improve the proficiency of the students in the acquisition of language skills mentioned above, the following text and course contents, divided into Five Units, are prescribed:

Text Books:

1. ***"Fluency in English – A Course book for Engineering Students"*** by Board of Editors**: Hyderabad: Orient BlackSwan Pvt. Ltd. 2016. Print.**
2. Raman, Meenakshi and Sharma, Sangeeta***. "Technical Communication- Principles and Practice"*. Third Edition. New Delhi: Oxford University Press. 2015. Print.**

The course content / study material is divided into **Five Units.**
<u>Note</u>: *Listening and speaking skills are covered in the syllabus of ELCS Lab.*

UNIT –I:
Chapter entitled '***Presidential Address' by Dr. A.P.J. Kalam*** from ***"Fluency in English– A Course book for Engineering Students"*** published by Orient BlackSwan, Hyderabad.

Vocabulary: Word Formation -- Root Words --The Use of Prefixes and Suffixes– Collocations– Exercises for Practice.
Grammar: Punctuation – Parts of Speech- Articles -Exercises for Practice.
Reading: ***Double Angels*** by David Scott-Reading and Its Importance- Techniques for Effective Reading- Signal Words- Exercises for Practice

Writing: Writing Sentences- Techniques for Effective Writing-- Paragraph Writing- Types, Structure and Features of a Paragraph-Coherence and Cohesiveness: Logical, Lexical and Grammatical Devices - Exercises for Practice

UNIT –II:

Chapter entitled ***Satya Nadella: Email to Employees on his First Day as CEO*** from ***"Fluency in English– A Course book for Engineering Students"*** Published by Orient BlackSwan, Hyderabad.

Vocabulary: Synonyms and Antonyms – Homonyms, Homophones, Homographs- Exercises for Practice (Chapter 17 ***'Technical Communication- Principles and Practice'. Third Edition*** published by Oxford University Press may also be followed.)

Grammar: Verbs-Transitive, Intransitive and Non-finite Verbs – Mood and Tense— Gerund – Words with Appropriate Prepositions – Phrasal Verbs - Exercises for Practice

Reading: Sub-skills of Reading- Skimming, Scanning, Extensive Reading and Intensive Reading - ***The Road Not Taken*** by **Robert Frost** -- Exercises for Practice

Writing: Letter Writing –Format, Styles, Parts, Language to be used in Formal Letters- Letter of Apology – Letter of Complaint-Letter of Inquiry with Reply – Letter of Requisition –- Exercises for Practice

UNIT –III:

From the book entitled ***'Technical Communication- Principles and Practice'. Third Edition*** published by Oxford University Press.

Vocabulary: Introduction- A Brief History of Words – Using the Dictionary and Thesaurus– Changing Words from One Form to Another – Confusables (From Chapter 17 entitled '*Grammar and Vocabulary Development*')

Grammar: Tenses: Present Tense- Past Tense- Future Tense- Active Voice – Passive Voice- Conditional Sentences – Adjective and Degrees of Comparison. (From Chapter 17 entitled '*Grammar and Vocabulary Development*')

Reading: Improving Comprehension Skills – Techniques for Good Comprehension- Skimming and Scanning- Non-verbal Signals – Structure of the Text – Structure of Paragraphs – Punctuation – Author's viewpoint (Inference) – Reader Anticipation: Determining the Meaning of Words – Summarizing- Typical Reading Comprehension Questions. (From Chapter 10 entitled '*Reading Comprehension*')

Writing: Introduction- Letter Writing-Writing the Cover Letter- Cover Letters Accompanying Resumes- Emails. (From Chapter 15 entitled '*Formal Letters, Memos, and Email'*)

UNIT –IV:

Chapter entitled ***'Good Manners' by J.C. Hill*** from ***Fluency in English – A Course book for***

Engineering Students" published by Orient Blackswan, Hyderabad.

Vocabulary: Idiomatic Expressions –One- word Substitutes --- Exercises for Practice (Chapter 17 ***'Technical Communication- Principles and Practice'. Third Edition*** published by Oxford University Press may also be followed.)

Grammar: Sequence of Tenses- Concord (Subject in Agreement with the Verb) – Exercises for Practice

Reading: ***'If'*** poem by **Rudyard Kipling**--Tips for Writing a Review --- Author's Viewpoint – Reader's Anticipation-- Herein the Students will be required to Read and Submit a Review of a Book (Literary or Non-literary) of their choice – Exercises for Practice.

Writing: Information Transfer-Bar Charts-Flow Charts-Tree Diagrams etc., -- Exercises for Practice.

Introduction - Steps to Effective Precis Writing – Guidelines- Samples (Chapter 12 entitled '*The Art of Condensation*' from ***Technical Communication- Principles and Practice. Third Edition*** published by Oxford University Press)

UNIT –V:

Chapter entitled ***'Father Dear Father'*** **by Raj Kinger** from ***Fluency in English – A Course book for Engineering Students"*** Published by Orient BlackSwan, Hyderabad

Vocabulary: Foreign Words—Words borrowed from other Languages- Exercises for Practice

Grammar: Direct and Indirect Speech- Question Tags- Exercises for Practice

Reading: Predicting the Content- Understanding the Gist – SQ3R Reading Technique- Study Skills – Note Making - Understanding Discourse Coherence – Sequencing Sentences. (From Chapter 10 entitled **'Reading Comprehension'** - ***Technical Communication- Principles and Practice. Third Edition*** published by Oxford University Press.)

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports –Formats- Prewriting – Structure of Reports (Manuscript Format) - Types of Reports - Writing the Report. (From Chapter 13 entitled **'Technical Reports'** - ***Technical Communication- Principles and Practice. Third Edition*** published by Oxford University Press.)

- **Exercises from both the texts not prescribed shall be used for classroom tasks.**

References

1 Green, David. *Contemporary English Grammar –Structures and Composition.* MacMillan India. 2014 (Print)

2. Rizvi, M. Ashraf. *Effective Technical Communication*. Tata Mc Graw –Hill. 2015 (Print).

ENGINEERING MECHANICS

B.Tech. I Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **ME105ES**	**3**	**0/0/0**	**3**

Pre Requisites: None

Course Objectives:

- To understand the resolving forces and moments for a given force system
- To analyze the types of friction for moving bodies and problems related to friction.
- To determine the centroid and second moment of area

UNIT-I

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems.

UNIT-II

Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions - Motion of Bodies – Wedge & Screw, Screw-jack.

UNIT-III

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of composite bodies.

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration. Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures.

UNIT-IV

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies.

UNIT-V

Kinetics: Kinetics of a particle-D'Alemberts principle. Work-energy and power. Principle of conservation of energy- Kinetics of rigid body in translation, rotation-work done-Principle of work-energy.

TEXT BOOKS:

1. Singer's Engineering Mechanics Statics and Dynamics/ K. Vijaya Kumar Reddy, J. Suresh Kumar/ BSP
2. Engineering Mechanics/ Irving Shames, G. Krishna Mohan Rao / Prentice Hall
3. Foundations and applications of Engineering Mechanics by HD Ram and AK Chouhan, Cambridge publications.
4. A Text Book of Engineering Mechanics/S.S. Bhavikatti/New Age International (P) Limited Publications, New Delhi.
5. Engineering Mechanics Statics and Dynamics/N. H. Dubey/ McGraw Hill Education (India) Private Limited, New Delhi.

REFERENCES:

1. A Text of Engineering Mechanics /YVD Rao/ K. Govinda Rajulu/ M. Manzoor Hussain / Academic Publishing Company
2. Engineering Mechanics / Bhattacharyya/ Oxford.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech. I Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **EE106ES/EE205ES:**	**4**	**0/0/0**	**4**

Pre-requisite: None

Course Objectives:

- To introduce the concept of electrical circuits and its components
- To introduce the concepts of diodes & transistors, and
- To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes: After this course, the student will be able

- To analyze and solve electrical circuits using network laws and theorems.
- To identify and characterize diodes and various types of transistors.

UNIT - I

Basic Concepts of Electrical Circuits and Single Phase AC Circuits

Electrical Circuits: R-L-C Parameters, Voltage and Current, Independent and Dependent Sources, Source Transformation – V-I relationship for passive elements, Kirchoff's Laws, Network reduction techniques – series, parallel, series-parallel, star-to-delta, delta-to-star transformation, Nodal Analysis,

Single Phase AC Circuits: R.M.S. and Average values, Form Factor, steady state analysis of series, parallel and series-parallel combinations of R, L and C with sinusoidal excitation, concept of reactance, impedance, susceptance and admittance – phase and phase difference, Concept of power factor, j-notation, complex and polar forms of representation.

UNIT - II

Resonance: Series resonance and Parallel resonance circuits, concept of bandwidth and Q factor.

Network Theorems: Thevenin's, Norton's, Maximum Power Transfer, Superposition and Reciprocity theorem for DC and AC excitations.

UNIT - III

P-N Junction and Zener Diode: Principle of Operation Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances.

Zener Diode: characteristics.

Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

UNIT - IV

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations.

Transistor Biasing And Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Emitter Feedback Bias, Collector to Emitter feedback bias, Voltage divider bias, Bias stability, Stabilization against variations in V_{BE} and β, Bias Compensation using Diodes and Transistors.

Transistor Configurations: Hybrid model, Determination of h-parameters from transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters, Comparison of CE, CB and CC configurations.

UNIT- V

Junction Field Effect Transistor: Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, Biasing FET.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

REFERENCES:

1. Electronic Devices and Circuits – R. L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.

ENGLISH LANGUAGE COMMUNICATION SKILLS (ELCS) LAB

B.Tech. I Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **EN107HS/EN207HS**	**0**	**0/3/0**	**2**

The **English Language Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize their mother tongue influence
- To train students to use language appropriately for public speaking, group discussions and interviews

Course Outcomes: Students will be able to attain:

- Better understanding of nuances of English language through audio- visual experience and group activities
- Neutralization of accent for intelligibility
- Speaking skills with clarity and confidence which in turn enhances their employability skills.

Syllabus: English Language Communication Skills Lab (ELCS) shall have two parts:

- **Computer Assisted Language Learning (CALL) Lab**
- **Interactive Communication Skills (ICS) Lab**

Listening Skills:

Objectives

- To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
- To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions.

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

- To involve students in speaking activities in various contexts
- To enable students express themselves fluently and appropriately in social and professional contexts :
  - Oral practice
  - Describing objects/situations/people
  - Role play – Individual/Group activities
  - Just A Minute (JAM) Sessions.

The following course content is prescribed for the **English Language Communication Skills Lab**.

Exercise – I
CALL Lab:
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.
Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters- Past Tense Marker and Plural Marker.
Testing Exercises
ICS Lab:
Understand: Spoken vs. Written language- Formal and Informal English.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II
CALL Lab:
Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Sentence Stress – Intonation.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Sentence Stress – Intonation.
Testing Exercises
ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.
Practice: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III
CALL Lab:
Understand: Errors in Pronunciation-the Influence of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation.
Testing Exercises
ICS Lab:
Understand: Descriptions- Narrations- Giving Directions and Guidelines.
Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IV
CALL Lab:
Understand: Listening for General Details.
Practice: Listening Comprehension Tests.
Testing Exercises
ICS Lab:
Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication- Presentation Skills.
Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V
CALL Lab:
Understand: Listening for Specific Details.
Practice: Listening Comprehension Tests.
Testing Exercises
ICS Lab:
Understand: Group Discussion- Interview Skills.
Practice: Group Discussion- Mock Interviews.

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**
   The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.
   System Requirement (Hardware component):
   Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

Computers with Suitable Configuration
High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**
   The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio and video system and camcorder etc.

Lab Manuals:

1) A book entitled "***ELCS Lab Manual – A Workbook for CALL and ICS Lab Activities"*** by Board of Editors: Hyderabad: Orient BlackSwan Pvt. Ltd. 2016. Print.
2) Hart, Steve; Nair, Aravind R.; Bhambhani, Veena. ***"EMBARK- English for undergraduates"*** Delhi: Cambridge University Press. 2016. Print.

Suggested Software:

1) Cambridge Advanced Learners' English Dictionary with CD.
2) Grammar Made Easy by Darling Kindersley.
3) Punctuation Made Easy by Darling Kindersley.
4) Oxford Advanced Learner's Compass, 8th Edition.
5) English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
6) English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
7) TOEFL and GRE (KAPLAN, AARCO and BARRONS, USA, Cracking GRE by CLIFFS).

References:

1) Jayashree Mohanraj. *Let Us Hear Them Speak*. New Delhi: Sage Texts. 2015. Print.
   Hancock, M. *English Pronunciation in Use. Intermediate Cambridge*: Cambridge University Press. 2009. Print.

ENGINEERING WORKSHOP

B.Tech. I Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **ME108ES/ME208ES**	**0**	**0/3/0**	**2**

Pre-requisites: Practical skill

Course Objective:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

Course Outcomes: At the end of the course, the student will be able to:

- Study and practice on machine tools and their operations
- Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.
- Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1) Carpentry
2) Fitting
3) Tin-Smithy and Development of jobs carried out and soldering.
4) Black Smithy
5) House-wiring
6) Foundry
7) Welding
8) Power tools in construction, wood working, electrical engineering and mechanical engineering.

2. TRADES FOR DEMONSTRATION and EXPOSURE:

- Plumbing, Machine Shop, Metal Cutting (Water Plasma)

Text books:

1) Workshop Practice /B. L. Juneja / Cengage
2) Workshop Manual / K.Venugopal / Anuradha.

Reference books:

1) Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech
2) Workshop Manual / Venkat Reddy/ BSP

PH201BS: ENGINEERING PHYSICS - II

I Year II Sem. B.Tech.

L	T/P/D	C
3	0/0/0	3

Course Objectives:

- To understand the behavior of a particle quantum mechanically.
- To be able to distinguish pure and impure semi conductors and understand formation of P-N Junction.
- To understand various magnetic and dielectric properties of materials.
- To study super conductor behavior of materials.

Course Outcomes: After completion of this course the student is able to

- Realize the importance of behavior of a particle quantum mechanically.
- Learn concentration estimation of charge carriers in semi conductors.
- Learn various magnetic dielectric properties and apply them in engineering application.
- Know the basic principles and applications of super conductors.

UNIT - I

Principles of Quantum Mechanics: Waves and particles, de-Broglie hypothesis, matter waves, Davisson and Germer experiment, Heisenberg uncertainty principle, Schrodinger time independent wave equation, physical significance of wave function, particle in 1-D potential box, electron in periodic potential, Kronig-Penny model (qualitative treatment), E-K curve, origin of energy band formation in solids.

UNIT - II

Semiconductor Physics: Fermi level in intrinsic and extrinsic semiconductors, calculation of carrier concentration in intrinsic & extrinsic semiconductors, direct and indirect band gap semiconductors, formation of PN junction, open circuit PN junction, energy diagram of PN junction diode, solar cell: I-V characteristics and applications.

UNIT - III

Dielectric Properties: Electric dipole, dipole moment, dielectric constant, polarizability, electric susceptibility, displacement vector, electronic, ionic and orientation polarizations and calculation of their polarizabilitites, internal field, Clausius-Mossotti relation, Piezoelectricity, pyroelectricity and ferroelectricity-$BaTiO_3$ structure.

UNIT - IV

Magnetic Properties & Superconductivity: Permeability, field intensity, magnetic field induction, magnetization, magnetic susceptibility, origin of magnetic moment, Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, hysteresis curve based on domain theory, soft and hard magnetic materials, properties of anti-ferro and ferri magnetic materials,

Superconductivity: Superconductivity phenomenon, Meissner effect, applications of superconductivity.

UNIT - V

Introduction to nanoscience: Origin of nanoscience, nanoscale, surface to volume ratio, quantum confinement, dominance of electromagnetic forces, random molecular motion, bottom-up fabrication: Sol-gel, CVD and PVD techniques, top-down fabrication: ball mill method, characterization by XRD, SEM and TEM.

Text Books:

1. Solid State Physics, A. J. Dekkar, Macmillan publishers Ind. Ltd.,
2. Solid State Physics, Chales Kittel, Wiley student edition.
3. Fundamentals of Physics, Alan Giambattisa, BM Richardson and Robert C Richardson, Tata Mcgrahill Publishers.

Reference Books:

1. Modern Engineering Physics, K. Vijaya Kumar, S. Chandralingam S. Chand & Co. Pvt. Ltd.,
2. University Physics, Francis W. Sears, Hugh D. Young, Marle Zeemansky and Roger A Freedman, Pearson Education.
3. Fundamentals of Acoustics, Kinster and Frey, John Wiley and Sons.
4. Introduction to Quantum Mechanics Leonard I. Schiff McGraw-Hill

MA102BS/MA202BS: MATHEMATICS - II
(Advanced Calculus)

B.Tech. I Year II Sem.	L	T/P/D	C
	4	1/0/0	4

Prerequisites: Foundation course (No prerequisites)**.**

Course Objectives: To learn

- concepts & properties of Laplace Transforms
- solving differential equations using Laplace transform techniques
- evaluation of integrals using Beta and Gamma Functions
- evaluation of multiple integrals and applying them to compute the volume and areas of regions
- the physical quantities involved in engineering field related to the vector valued functions.
- the basic properties of vector valued functions and their applications to line, surface and volume integrals.

Course Outcomes: After learning the contents of this course the student must be able to

- use Laplace transform techniques for solving DE's
- evaluate integrals using Beta and Gamma functions
- evaluate the multiple integrals and can apply these concepts to find areas, volumes, moment of inertia etc of regions on a plane or in space
- evaluate the line, surface and volume integrals and converting them from one to another

UNIT – I

Laplace Transforms: Laplace transforms of standard functions, Shifting theorems, derivatives and integrals, properties- Unit step function, Dirac's delta function, Periodic function, Inverse Laplace transforms, Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT - II

Beta and Gamma Functions: Beta and Gamma functions, properties, relation between Beta and Gamma functions, evaluation of integrals using Beta and Gamma functions.

Applications: Evaluation of integrals.

UNIT – III

Multiple Integrals: Double and triple integrals, Change of variables, Change of order of integration. **Applications:** Finding areas, volumes& Center of gravity (evaluation using Beta and Gamma functions).

UNIT – IV

Vector Differentiation: Scalar and vector point functions, Gradient, Divergence, Curl and their physical and geometrical interpretation, Laplacian operator, Vector identities.

UNIT – V

Vector Integration: Line Integral, Work done, Potential function, area, surface and volume integrals, Vector integral theorems: Greens, Stokes and Gauss divergence theorems (without proof) and related problems.

Text Books:

1. Advanced Engineering Mathematics by R K Jain & S R K Iyengar, Narosa Publishers
2. Engineering Mathematics by Srimanthapal and Subodh C. Bhunia, Oxford Publishers

References:

1. Advanced Engineering Mathematics by Peter V. O. Neil, Cengage Learning Publishers.
2. Advanced Engineering Mathematics by Lawrence Turyn, CRC Press

MA203BS: Mathematics - III
(Statistical and Numerical Methods)

I Year II Sem. B.Tech.	**L**	**T/P/D**	**C**
	4	**1/0/0**	**4**

Prerequisites: Foundation course (No prerequisites)**.**

Course Objectives: To learn

- random variables that describe randomness or an uncertainty in certain realistic situation
- binomial geometric and normal distributions
- sampling distribution of mean, variance, point estimation and interval estimation
- the testing of hypothesis and ANOVA
- the topics those deals with methods to find roots of an equation
- to fit a desired curve by the method of least squares for the given data
- solving ordinary differential equations using numerical techniques

Course Outcomes: After learning the contents of this course the student must be able to

- differentiate among random variables involved in the probability models which are usefull for all branches of engineering
- calculate mean, proportions and variances of sampling distributions and to make important decisions s for few samples which are taken from a large data
- solve the tests of ANOVA for classified data
- find the root of a given equation and solution of a system of equations
- fit a curve for a given data
- find the numerical solutions for a given first order initial value problem

UNIT – I

Random variables and Distributions:

Introduction, Random variables, Discrete random variable, Continuous random variable, Distribution function, Expectation, Moment generating function, Moments and properties.
Discrete distributions: Binomial and geometric distributions. Continuous distribution: Normal distributions.

UNIT – II

Sampling Theory: Introduction, Population and samples, Sampling distribution of means (σ Known)-Central limit theorem, t-distribution, Sampling distribution of means (σunknown)-Sampling distribution of variances – $\chi^2$and F- distributions, Point estimation, Maximum error of estimate, Interval estimation.

UNIT – III

Tests of Hypothesis: Introduction, Hypothesis, Null and Alternative Hypothesis, Type I and Type II errors, Level of significance, One tail and two-tail tests, Tests concerning one mean and proportion, two means-proportions and their differences-ANOVA for one-way classified data.

UNIT – IV

Algebraic and Transcendental Equations & Curve Fitting: Introduction, Bisection Method, Method of False position, Iteration methods: fixed point iteration and Newton Raphson methods. Solving linear system of equations by Gauss-Jacobi and Gauss-Seidal Methods.

Curve Fitting: Fitting a linear, second degree, exponential, power curve by method of least squares.

UNIT – V

Numerical Integration and solution of Ordinary Differential equations: Trapezoidal rule-Simpson's $1/3^{rd}$ and $3/8^{th}$ rule- Solution of ordinary differential equations by Taylor's series, Picard's method of successive approximations, Euler's method, Runge-Kutta method (second and fourth order)

Text Books:

1. Probability and Statistics for Engineers by Richard Arnold Johnson, Irwin Miller and John E. Freund, New Delhi, Prentice Hall.
2. Probability and Statistics for Engineers and Sciences by Jay L. Devore, Cengage Learning.
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar and R. K. Jain, New Age International Publishers

References:

1. Fundamentals of Mathematical Statistics by S. C. Guptha & V. K. Kapoor, S. Chand
2. Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning Pvt. Ltd

CS104ES/CS204ES: COMPUTER PROGRAMMING IN C

I Year II Sem. B.Tech.	**L**	**T/P/D**	**C**
	3	**0/0/0**	**3**

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in Program development.
- To learn the syntax and semantics of C Programming Language.
- To learn how to write modular and readable C Programs.
- To learn to write programs using structured programming approach in C to solve problems.

Course Outcomes:

- Demonstrate the basic knowledge of computer hardware and software.
- Ability to write algorithms for solving problems.
- Ability to draw flowcharts for solving problems.
- Ability to code a given logic in C programming language.
- Gain knowledge in using C language for solving problems.

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Program Development, algorithms and flowcharts , Number systems-Binary, Decimal, Hexadecimal and Conversions, storing integers and real numbers.

Introduction to C Language – Background, C Programs, Identifiers, Types, Variables, Constants, Input / Output, Operators(Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements- Selection Statements(making decisions) – if and switch statements, Repetition statements (loops)-while, for, do-while statements, Loop examples, other statements related to looping – break, continue, goto, Simple C Program examples.

UNIT - II

Functions-Designing Structured Programs, Functions, user defined functions, inter function communication, Standard functions, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, Limitations of recursion, example C programs.

Arrays – Concepts, using arrays in C, inter function communication, array applications- linear search, binary search and bubble sort, two – dimensional arrays, multidimensional arrays, C program examples.

UNIT - III

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications-Arrays and Pointers, Pointer Arithmetic and arrays, Passing an array to a function, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

UNIT - IV

Enumerated, Structure ,and Union Types– The Type Definition (typedef), Enumerated types, Structures –Declaration, initialization, accessing structures, operations on structures, Complex structures-Nested structures, structures containing arrays, structures containing pointers, arrays of structures, structures and functions, Passing structures through pointers, self referential structures, unions, bit fields, C programming examples, command–line arguments, Preprocessor commands.

UNIT – V

Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling), Positioning functions (fseek ,rewind and ftell), C program examples.

Text Books:

1. Computer Science: A Structured Programming Approach Using C, B. A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh , Second Edition, Oxford University Press.

Reference Books:

1. The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, Second Edition, Pearson education.
2. Programming with C, B. Gottfried, 3rd edition, Schaum's outlines, McGraw Hill Education (India) Pvt Ltd.
3. C From Theory to Practice, G S. Tselikis and N D. Tselikas, CRC Press.
4. Basic computation and Programming with C, Subrata Saha and S. Mukherjee, Cambridge University Press.

ME106ES/ME205ES: ENGINEERING GRAPHICS

I Year II Sem. B.Tech.	**L**	**T/P/D**	**C**
	2	**0/0/4**	**4**

Pre-requisites: None

Course objectives:

- To provide basic concepts in engineering drawing.
- To impart knowledge about standard principles of orthographic projection of objects.
- To draw sectional views and pictorial views of solids.

Course Outcomes:

- Ability to prepare working drawings to communicate the ideas and information.
- Ability to read, understand and interpret engineering drawings.

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections. Involute, Cycloid, Epicycloid and Hypocycloid Scales – Plain & Diagonal.

UNIT - II

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Straight Lines. Projections of Plane regular geometric figures.— Auxiliary Planes.

UNIT – III

Projections of Regular Solids – Auxiliary Views.

UNIT – IV

Sections and Developments: Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views. Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid, and Cone.

UNIT – V

Isometric & Orthographic Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple Solids – Conversion of Isometric Views to Orthographic Views.

Text Books:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
3. Engineering Drawing/ M.B. Shah, B.C. Rane / Pearson.

4. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

CH206BS: ENGINEERING CHEMISTRY LAB

I Year II Sem. B.Tech.

L	T/P/D	C
0	0/3/0	2

LIST OF EXPERIMENTS

Volumetric Analysis:

1. Estimation of Ferrous ion by Dichrometry.
2. Estimation of hardness of water by Complexometric method using EDTA.
3. Estimation of Ferrous and Ferric ions in a given mixture by Dichrometry.
4. Estimation Ferrous ion by Permanganometry.
5. Estimation of copper by Iodomery.
6. Estimation of percentage of purity of MnO_2 in pyrolusite
7. Determination of percentage of available chlorine in bleaching powder.
8. Determination of salt concentration by ion- exchange resin.

Instrumental methods of Analysis:

1. Estimation of HCl by Conductometry.
2. Estimation of Ferrous ion by Potentiometry.
3. Determination of Ferrous iron in cement by Colorimetric method.
4. Determination of viscosity of an oil by Redwood / Oswald's Viscometer.
5. Estimation of manganese in $KMnO_4$ by Colorimetric method.
6. Estimation o f HCl and Acetic acid in a given mixture by Conductometry.
7. Estimation of HCl by Potentiometry.

Preparation of Polymers:

1. Preparation of Bakelite and urea formaldehyde resin.

Text Books:

1. Vogel's Text Book of Quantitative Chemical Analysis, 5th Edition (2015)
2. G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney.
3. A Text Book on experiments and calculations in Engineering Chemistry by S.S. Dara S. Chand & Company Ltd., Delhi (2003).

PH107BS/PH207BS: ENGINEERING PHYSICS LAB

I Year II Sem. B.Tech.	**L**	**T/P/D**	**C**
	0	**0/3/0**	**2**

LIST OF EXPERIMENTS

1. Dispersive power of the material of a prism – Spectrometer.
2. Determination of wavelengths of white source – Diffraction grating.
3. Newton's Rings – Radius of curvature of Plano convex lens.
4. Melde's experiment – Transverse and longitudinal modes.
5. Charging, discharging and time constant of an R-C circuit.
6. L-C-R circuit – Resonance & Q-factor.
7. Magnetic field along the axis of current carrying coil – Stewart and Gees method and to verify Biot – Savart's law.
8. Study the characteristics of LED and LASER diode.
9. Bending losses of fibres & Evaluation of numerical aperture of a given fibre.
10. Energy gap of a material of p-n junction.
11. Torsional pendulum – Rigidity modulus.
12. Wavelength of light, resolving power and dispersive power of a diffraction grating using laser.
13. V-I characteristics of a solar cell.

(Any TEN experiments compulsory)

CS108ES/CS208ES: COMPUTER PROGRAMMING IN C LAB

I Year II Sem. B.Tech.

L	T/P/D	C
0	0/3/0	2

Course Objective:

- To write programs in C using structured programming approach to solve the problems.

Course Outcomes:

- Ability to design and test programs to solve mathematical and scientific problems.
- Ability to write structured programs using control structures and functions.

Recommended Systems/Software Requirements:

- Intel based desktop PC
- GNU C Compiler

1. **a)** Write a C program to find the factorial of a positive integer.
b) Write a C program to find the roots of a quadratic equation.

2. **a)** Write a C program to determine if the given number is a prime number or not.
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.

3. **a)** Write a C program to construct a pyramid of numbers.
b) Write a C program to calculate the following Sum:
$Sum=1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$

4. **a)** The least common multiple (lcm) of two positive integers a and b is the smallest integer that is evenly divisible by both a and b. Write a C program that reads two integers and calls lcm (a, b) function that takes two integer arguments and returns their lcm. The lcm (a, b) function should calculate the least common multiple by calling the gcd (a, b) function and using the following relation:

LCM (a,b) = ab / gcd (a,b)

b) Write a C program that reads two integers n and r to compute the ncr value using the following relation:
ncr (n,r) = n! / r! (n-r)! . Use a function for computing the factorial value of an integer.

5. **a)** Write C program that reads two integers x and n and calls a recursive function to compute x^n
b) Write a C program that uses a recursive function to solve the Towers of Hanoi problem.

c) Write a C program that reads two integers and calls a recursive function to compute ncr value.

6. a) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user using Sieve of Eratosthenes algorithm.

b) Write a C program that uses non recursive function to search for a Key value in a given list of integers. Use linear search method.

7. a) Write a menu-driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

b) Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers. Use binary search method.

8 a) Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.

b) Write a C program that reads two matrices and uses functions to perform the following:

1. Addition of two matrices
2. Multiplication of two matrices

9. a) Write a C program that uses functions to perform the following operations:

1. to insert a sub-string into a given main string from a given position.
2. to delete n characters from a given position in a given string.

b) Write a C program that uses a non recursive function to determine if the given string is a palindrome or not.

10. a) Write a C program to replace a substring with another in a given line of text.

b) Write a C program that reads 15 names each of up to 30 characters, stores them in an array, and uses an array of pointers to display them in ascending (ie. alphabetical) order.

11. a) 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.

b) Write a C program to convert a positive integer to a roman numeral. Ex. 11 is converted to XI.

12. a) Write a C program to display the contents of a file to standard output device.

b) Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.

13. a) Writ**e a C** program to count the number of times a character occurs in a text file. The file name and the character are supplied as command-line arguments.

b) Write a C program to compare two files, printing the first line where they differ.

14. a) Write a C program to change the nth character (byte) in a text file. Use fseek function.

b) Write a C program to reverse the first n characters in a file. The file name and n are specified on the command line. Use fseek function.

15. a) Write a C program to merge two files into a third file (i.e., the contents of the firs t file followed by those of the second are put in the third file).

b) Define a macro that finds the maximum of two numbers. Write a C program that uses the macro and prints the maximum of two numbers.

Reference Books:

1. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publishers.
2. Computer Programming in C, V. Rajaraman ,PHI.
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. C++: The complete reference, H. Schildt, TMH Publishers.

MA301BS: MATHEMATICS - IV
(Complex Variables and Fourier Analysis)

B.Tech. II Year I Sem.

L	T	P	C
4	1	0	4

Prerequisites: Foundation course (No Prerequisites)**.**

Course Objectives: To learn

- differentiation and integration of complex valued functions
- evaluation of integrals using Cauchy's integral formula
- Laurent's series expansion of complex functions
- evaluation of integrals using Residue theorem
- express a periodic function by Fourier series and a non-periodic function by Fourier transform
- to analyze the displacements of one dimensional wave and distribution of one dimensional heat equation

Course Outcomes: After learning the contents of this paper the student must be able to

- analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem
- find the Taylor's and Laurent's series expansion of complex functions
- the bilinear transformation
- express any periodic function in term of sines and cosines
- express a non-periodic function as integral representation
- analyze one dimensional wave and heat equation

UNIT – I

Functions of a complex variable: Introduction, Continuity, Differentiability, Analyticity, properties, Cauchy, Riemann equations in Cartesian and polar coordinates**.** Harmonic and conjugate harmonic functions-Milne-Thompson method

UNIT - II

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, and Generalized Cauchy's integral formula, Power series: Taylor's series- Laurent series, Singular points, isolated singular points, pole of order m – essential singularity, Residue, Cauchy Residue theorem (Without proof).

UNIT – III

Evaluation of Integrals: Types of real integrals:

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

Bilinear transformation- fixed point- cross ratio- properties- invariance of circles.

UNIT – IV

Fourier series and Transforms: Introduction, Periodic functions, Fourier series of periodic function, Dirichlet's conditions, Even and odd functions, Change of interval, Half range sine and cosine series.

Fourier integral theorem (without proof), Fourier sine and cosine integrals, sine and cosine, transforms, properties, inverse transforms, Finite Fourier transforms.

UNIT – V

Applications of PDE: Classification of second order partial differential equations, method of separation of variables, Solution of one dimensional wave and heat equations.

TEXT BOOKS:

1. A first course in complex analysis with applications by Dennis G. Zill and Patrick Shanahan, Johns and Bartlett Publishers.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.
3. Advanced engineering Mathematics with MATLAB by Dean G. Duffy

REFERENCES:

1. Fundamentals of Complex Analysis by Saff, E. B. and A. D. Snider, Pearson.
2. Advanced Engineering Mathematics by Louis C. Barrett, McGraw Hill.

EE302ES: ELECTROMAGNETIC FIELDS

B.Tech. II Year I Sem.

L	T	P	C
4	1	0	4

Prerequisite: Mathematics II & Physics II

Course Objectives:

- To introduce the concepts of electric field, magnetic field.
- Applications of electric and magnetic fields in the development of the theory for power transmission lines and electrical machines.

Course Outcomes: upon completion of course, student will be able to

- Apply vector calculus to static electric – magnetic fields.
- Compute the force, fields & Energy for different charge & current configurations & evaluate capacitance and inductance
- Analyze Maxwell's equation in different forms (Differential and integral) in Electrostatic, Magnetic time varying fields

UNIT – I

Electrostatics: Electrostatic Fields – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential – Properties of potential function – Potential gradient – Guass's law – Application of Guass's Law – Maxwell's first law, div (D)=ρv – Laplace's and Poison's equations – Solution of Laplace's equation in one variable. Electric dipole – Dipole moment – potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field – Behavior of conductors in an electric field – Conductors and Insulators

UNIT – II

Dielectrics & Capacitance: Behavior of conductors in an electric field – Conductors and Insulators – Electric field inside a dielectric material – polarization – Dielectric – Conductor and Dielectric – Dielectric boundary conditions – Capacitance – Capacitance of parallel plots – spherical co-axial capacitors – with composite dielectrics – Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of continuity

UNIT – III

Magneto Statics: Static magnetic fields – Biot-Savart's law – Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation, div(B)=0,

Ampere's Law & Applications: Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law – Maxwell's third equation, Curl (H)=Jc

UNIT – IV

Force in Magnetic fields and Magnetic Potential: Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic field – Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field Scalar Magnetic potential and its limitations – vector magnetic potential and its properties – vector magnetic potential due to simple configurations – vector Poisson's equations.

Self and Mutual inductance – Neumann's formulae – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field. Introduction to permanent magnets, their characteristics and applications.

UNIT – V

Time Varying Fields: Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms – Maxwell's fourth equation, Curl (E)=-∂B/∂t – Statically and Dynamically induced EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current

TEXT BOOKS:

1. "William H. Hayt & John. A. Buck", "Engineering Electromagnetics" ,Mc. Graw-Hill Companies, 7th Edition, 2009.
2. "Sadiku", "Electromagnetic Fields", Oxford Publications, 4th Edition, 2009.

REFERENCE BOOKS:

1. "CR Paul and S. A. Nasar", "Introduction to Electromagnetic", Mc-Graw Hill Publications, 3rd Edition, 1997.
2. "Nathan Ida", "Engineering Electromagnetic", Springer (India) Pvt. Ltd. 2nd Edition, 2015.
3. "D J Griffiths", "Introduction to Electro Dynamics", Prentice-Hall of India Pvt. Ltd, 3rd edition, 1999.
4. D J Griffiths", "Introduction to Electro Dynamics", Pearson New International, 4th edition, 2014.
5. "J. D Kraus", "Electromagnetics", Mc Graw-Hill Inc. 4th edition, 1992.

EE303ES: ELECTRICAL MACHINES – I

B.Tech. II Year I Sem.

L	T	P	C
4	1	0	4

Prerequisite: Basic electrical & Electronics Engineering

Course Objectives:

- To study and understand different types of DC generators, Motors and Transformers, their construction, operation and applications.
- To analyze performance aspects of various testing methods.

Course Outcomes: After this course, the student will be able to

- Identify different parts of a DC machine & understand its operation
- Carry out different testing methods to predetermine the efficiency of DC machines
- Understand different excitation and starting methods of DC machines
- Control the voltage and speed of a DC machines

UNIT – I

D.C. Generators: Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E. M.F Equation.

Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation. Methods of Excitation – separately excited and self excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self excite and remedial measures. Load characteristics of shunt, series and compound generators

UNIT – II

D.C Motors: Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation. Speed control of D.C. Motors - Armature voltage and field flux control methods. Motor starters (3 point and 4 point starters) Testing of D.C. machines - Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency.

UNIT - III

Methods of Testing – direct, indirect, and regenerative testing – Brake test – Swinburne's test – Hopkinson's test – Field's test - separation of stray losses in a d.c. motor test.

UNIT - IV

Single phase transformers: Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load - phasor diagrams

Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses.

UNIT - V

OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test-parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers.

Polyphase transformers - Polyphase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and openΔ

TEXT BOOKS:

1. "I.J. Nagrath & D.P. Kothari", "Electric Machines", Tata Mc Graw Hill Publishers, 3rd edition, 2004.
2. "P.S. Bimbra", "Electrical Machines", Khanna Publishers, 7th Edition, 2014.

REFERENCE BOOKS:

1. E. Clayton & N. M. Hancock "The Performance and Design Of Direct Current Machines" 3rd Edition Pitman, London 1959.
2. "A. E. Fritzgerald, C. Kingsley and S. Umans", "Electric Machinary", McGraw Hill Companies, 6th edition, 2003.
3. "Abhijith Chakrabarthi & SubithaDebnath", "Electrical Machines", Mc Graw Hill, 2015.

EE304ES: NETWORK THEORY

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics - II & Basic Electrical and Electronics Engineering

Course Objectives:

- To understand Magnetic Circuits, Network Topologyand Three phase circuits.
- To analyze transients in Electrical systems.
- To evaluate Network parameters of given Electrical network
- To design basic filter configurations

Course Outcomes: After this course, the student will be able to

- Analyze the Electrical Circuits with the concept of Network topology
- Apply the concepts of Magnetic circuit & Analyze Magnetic circuits
- Determine self and mutually induced EMF's for Magnetically coupled coils
- Understand the importance of three phase circuits and Analyze the three phase circuits with Star & Delta connected balanced and unbalanced loads
- Analyze the transient behavior of electrical networks for various excitations
- Obtain the various network parameters for the given two port networks
- Represent the transfer function for the given network
- Determine the parameters for the design of various filters

UNIT – I

Magnetic Circuits: Faraday's laws of electromagnetic induction – concept of self and mutual inductance – dot convention – coefficient of coupling – composite magnetic circuit - Analysis of series and parallel magnetic circuits

Network topology: Definitions– Graph – Tree, Basic cutset and Basic Tieset matrices for planar networks – Loop and Nodal methods of analysis of Networks with dependent & independent voltage and current sources - Duality & Dual networks.

UNIT – II

Three phase circuits: Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – Measurement of active and reactive power.

UNIT – III

Transient Analysis: Transient response of R-L, R-C, R-L-C circuits (Series and Parallel combinations) for D.C. and sinusoidal excitations – Initial conditions – Classical method and Laplace transforms methods of solutions.

Transient response of the above circuits for different inputs such as step, ramp, pulse and impulse by using Laplace transforms method.

UNIT – IV

Network Parameters: Network functions driving point and transfer impedance function networks- poles and zeros –necessary conditions for driving point function and for transfer function

Two port network parameters – Z, Y, ABCD and hybrid parameters and their relations– 2-port network parameters using transformed variables.

UNIT – V

Filters: Introduction to filters –low pass – high pass and band pass – RC, RL, filters- constant K and m derived filters and composite filter design

TEXT BOOKS:

1. "William Hayt and Jack E. Kemmerly", "Engineering circuit analysis", Mc Graw Hill Company, 6th edition, 2016.
2. "D. Roy Chowdary", "Networks and systems", New age international publishers, 2009.
3. "N. C. Jagan & C. Lakshminarayana", "Network Theory", B.S Publications, 2014.
4. "A. Chakrabarthy", Circuit Theory, Dhanpat Rai, 2005.

REFERENCE BOOKS:

1. "Van Valkenburg", "Network Analysis", PHI, 3rd Edition, 2014
2. "Franklin F Kuo," "Network Analysis & Synthesis", Wiley India PVT. Ltd., second Edition, 2006
3. "K.C. A. Smith & R. E. Alley", "Electrical Circuits", Cambridge University Press, 1992
4. "K. Rajeswaran", "Electric Circuit theory", Pearson Education, 2004.
5. "A. Bruce Carlson", "Circuits", Thomson Publishers, 1999

EE305ES: ELECTRONIC CIRCUITS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Basic Electrical and Electronics Engineering

Course Objectives:

- To explain the operation, design and Analysis of single stage amplifiers using BJT and MOSFET.
- To analyze feedback amplifiers, large signal and oscillators.
- To explain the operation of linear and non linear wave shaping circuits
- To understand the switching characteristics of diode and transistor

Course Outcomes: After completion of this course the student is able to

- Apply the knowledge of BJT to design practical amplifier circuits.
- Design electronic sub systems such as feedback amplifiers, oscillators and power amplifiers to meet the required specifications.
- Design linear and non linear wave shaping circuits with different inputs.
- Analyze multi vibrators using transistors.

UNIT-I

Single Stage Amplifiers: Analysis of CE,CB,&CC Amplifiers Classification of Amplifiers Distortion in Amplifiers, Comparison of CE, CB, CC Amplifiers Low frequency Analysis, Low frequency response of BJT Amplifiers ,Low frequency response of FET Amplifiers Miller Effect Capacitance, High Frequency response of BJT amplifiers, Square Wave Testing.

UNIT –II

Feedback Amplifiers: Concept of feedback Amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Voltage series, voltage shunt ,Current series and current shunt Feedback configurations, Illustrative problems

Oscillators: Conditions for oscillations, Frequency and Amplitude Stability of Oscillators, Generalized analysis of LC Oscillators, Quartz, Hartley, and Colpitt's Oscillators, RC –phase shift and Wein Bridge oscillators.

UNIT-III

Large Signal Amplifiers: Class A Power Amplifier, Maximum Efficiency of Class –A Amplifier, Transformer Coupled Amplifier, Push Pull Amplifier complimentary Symmetry Class-B Power Amplifier, Phase Inverters, Transistor Power Dissipation, Thermal Runway, Heat Sinks

UNIT - IV

Wave Shaping: High Pass, Low Pass RC Circuits, their response for Sinusoidal, Step, Pulse and Ramp Inputs.

Clippers and Clampers: Diode Clippers, Transistor Clippers, Clipping at Two Independent Levels, Transfer Characteristics of Clippers, Comparators, Clamping Operation, Clamping Circuits using Diode with different inputs, Clamping Circuit Theorem, Practical Clamping Circuits.

UNIT - V

Switching Characteristics of Devices: Diode as a Switch, Piecewise Linear Diode Characteristics, Transistor as a Switch, Breakdown Voltage Consideration of Transistor, Design of Transistor Switch, Transistor Switching Times.

Multivibrators: Analysis and Design of Bistable, Monostable, Astable, Multivibrators and Schmitt Trigger using Transistors.

TEXT BOOKS:

1. "Robert L Boylestead and Louis Nashelsky", "Electronic Devices and circuit theory", Pearson, Tenth edition 2009
2. "S. Salivahanan, N. Suresh Kumar and A. Vallava Raj", "Electronic Devices and circuits", TMH, 2nd Edition 2008.
3. "David A. Bell", "Solid state Pulse Circuits", PHI ,4th Edition 2007.

REFERENCE BOOKS:

1. "Robert T. Paynter", "Introductory Electronic Devices and Circuits", PEI,7 Edition, 2009.
2. "Anil. K. Maini, Varsha Agarwal", "Electronic Devices and Circuits", Wiley, 1st Edition 2009.
3. "Jacob Milliman, Harbert Taub and Mothiki S Prakash Rao", "Pulse Digital & Switching Waveforms", TMH, 2nd Edition 2008.

EE306ES: ELECTRICAL MACHINES LAB – I

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

Prerequisite: Electrical Machines-I

Course Objectives:

- To expose the students to the operation of DC Generator
- To expose the students to the operation of DC Motor.
- To examine the self excitation in DC generators.

Course Outcomes: After completion of this lab the student is able to

- Start and control the Different DC Machines.
- Assess the performance of different machines using different testing methods
- Identify different conditions required to be satisfied for self - excitation of DC Generators.
- Separate iron losses of DC machines into different components

The following experiments are required to be conducted compulsory experiments:

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.

2. Load test on DC shunt generator. Determination of characteristics.

3. Load test on DC series generator. Determination of characteristics.

4. Load test on DC compound generator. Determination of characteristics.

5. Hopkinson's test on DC shunt machines. Predetermination of efficiency.

6. Fields test on DC series machines. Determination of efficiency.

7. Swinburne's test and speed control of DC shunt motor. Predetermination of efficiencies.

8. Brake test on DC compound motor. Determination of performance curves.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

9. Brake test on DC shunt motor. Determination of performance curves.

10. Retardation test on DC shunt motor. Determination of losses at rated speed.

11. Separation of losses in DC shunt motor.

EC306ES: ELECTRONIC DEVICES AND CIRCUITS LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

Course Objectives:

- To identify various components and testing of active devices.
- To study and operation of millimeters, function generators ,regulated power supplies and CRO To know the characteristics of various active devices.
- To study frequency response amplifier.

Course Outcomes:

- After Completion of the course the student is able to Apply various devices to real time problems.
- Compute frequency response of various amplifiers.

Part A: (Only for viva-voce Examination)

ELECTRONIC WORKSHOP PRACTICE (in 3 lab sessions):

1. Identification, Specification, testing of R,L,C components (color codes), Potentiometers (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Board, PCB's
2. Identification, Specification, testing of Active devices: Diodes, BJT, Low power JFET's, MOSFET's, Power Transistors, LED's, LCD's, SCR, UJT.
3. Study and operation of:
   i. Multimeters (Analog and Digital)
   ii. Function Generator
   iii. Regulated Power Supplies
   iv. CRO

Part B: (For Laboratory Examination – Minimum of 12 experiments)

1. Forward and Reverse Bias V-I characteristics of PN junction Diode.
2. Zener diode V-I characteristics and Zener diode as voltage regulator.
3. Half Wave rectifier, with and without filters
4. Full wave rectifier with and without filters.
5. Input and output Characteristics of a BJT in CE configuration and calculation of h-parameters.
6. Input and output Characteristics of a BJT in CB configuration and calculation of h-parameters.
7. FET characteristics in CS configuration.
8. Design of self bias circuit
9. Frequency response of CE Amplifier.
10. Frequency response of CC Amplifier.
11. Frequency response of CS FET Amplifier.
12. SCR characteristics.

13. UJT characteristics.

PART C: Equipment required for Laboratory:

1. Regulated Power supplies (RPS) : 0-30 V
2. CRO's : 0-20 MHz.
3. Function Generators : 0-1 MHz.
4. Multimeters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital) : 0-20 µA, 0-50µA, 0-100µA, 0-200µA,10 mA.
8. Voltmeters (Analog or Digital) : 0-50V, 0-100V, 0-250V
9. Electronic Components: Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs, FETs, LEDs, MOSFETs, Diodes-Ge & Si type, Transistors – NPN, PNP type

EE307ES: NETWORKS LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

Prerequisite: Basic Electrical and Electronics Engineering, Network Theory & Mathematics - II

Course Objectives:

- To design electrical systems
- To analyze a given network by applying various Network Theorems
- To measure three phase Active and Reactive power.
- To understand the locus diagrams

Course Outcomes: After Completion of this lab the student is able to

- Analyze complex DC and AC linear circuits
- Apply concepts of electrical circuits across engineering
- Evaluate response in a given network by using theorems

The following experiments are required to be conducted as compulsory experiments

1. Verification of Thevenin's and Norton's Theorems
2. Verification of Superposition ,Reciprocity and Maximum Power Transfer theorems
3. Locus Diagrams of RL and RC Series Circuits
4. Series and Parallel Resonance
5. Time response of first order RC / RL network for periodic non – sinusoidal inputs – Time constant and Steady state error determination.
6. Two port network parameters – Z – Y parameters, Analytical verification.
7. Two port network parameters – A, B, C, D & Hybrid parameters, Analytical verification
8. Separation of Self and Mutual inductance in a Coupled Circuit. Determination of Co-efficient of Coupling.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

9. Verification of compensation & Milliman's theorems
10. Harmonic Analysis of non-sinusoidal waveform signals using Harmonic Analyzer and plotting frequency spectrum.
11. Determination of form factor for non-sinusoidal waveform
12. Measurement of Active Power for Star and Delta connected balanced loads
13. Measurement of Reactive Power for Star and Delta connected balanced loads

MC300ES: ENVIRONMENTAL SCIENCE AND TECHNOLOGY

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	0

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

Course Outcomes:

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest 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: 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. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics

of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

EC401ES: SWITCHING THEORY AND LOGIC DESIGN

B.Tech. II Year II Sem.

L	T	P	C
3	1	0	3

Course Objectives:
This course provides in-depth knowledge of switching theory and the design techniques of digital circuits, which is the basis for design of any digital circuit. The main objectives are:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

Course Outcomes: Upon completion of the course, students should possess the following skills:

- Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray and BCD.
- Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Be able to design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
- Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

UNIT – I

Number System and Boolean algebra And Switching Functions: Review of number systems, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Error Detecting and Correcting Codes.

Boolean Algebra: Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT - II

Minimization and Design of Combinational Circuits: Introduction, The Minimization of switching function using theorem, The Karnaugh Map Method-Up to Five Variable Maps, Don’t Care Map Entries, Tabular Method, Design of Combinational Logic: Adders,

Subtractors, comparators, Multiplexers, Demultiplexers, Decoders, Encoders and Code converters, Hazards and Hazard Free Relations.

UNIT - III

Sequential Machines Fundamentals and Applications: Introduction: Basic Architectural Distinctions between Combinational and Sequential circuits, The Binary Cell, Fundamentals of Sequential Machine Operation, Latches, Flip Flops: SR, JK, Race Around Condition in JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Design of a Clocked Flip-Flop, Timing and Triggering Consideration, Clock Skew, Conversion from one type of Flip-Flop to another.

Registers and Counters: Shift Registers, Data Transmission in Shift Registers, Operation of Shift Registers, Shift Register Configuration, Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation Of Asynchronous And Synchronous Counters.

UNIT - IV

Sequential Circuits - I: Introduction, State Diagram, Analysis of Synchronous Sequential Circuits, Approaches to the Design of Synchronous Sequential Finite State Machines, Synthesis of Synchronous Sequential Circuits, Serial Binary Adder, Sequence Detector, Parity-bit Generator, Design of Asynchronous Counters, Design of Synchronous Modulo N – Counters.

UNIT - V

Sequential Circuits - II: Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques, and Merger chart methods-concept of minimal cover table.

TEXT BOOKS:

1. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rdEdition, Cambridge.
2. Digital Design- Morris Mano, 5rd Edition, Pearson.

REFERENCE BOOKS:

1. Modern Digital electronics RP Jain 4th Edition, McGraw Hill
2. Switching Theory and Logic Design – A Anand Kumar, 3rd Edition, PHI, 2013.

EE402ES: POWER SYSTEMS – I

B.Tech. II Year II Sem.

L	T	P	C
4	1	0	4

Prerequisite: Network theory

Course Objectives:

- To understand the hydro, thermal, nuclear and gas generating stations.
- To examine A.C. and D.C. distribution systems.
- To understand and compare air insulated and gas insulated substations.
- To illustrate the economic aspects of power generation and tariff methods.

Course Outcomes: After Completion of this course the student is able to

- Draw the layout of hydro power plant, thermal power station, Nuclear power plant and gas power plant and explain its operation
- Describe A.C. and D.C. distribution systems and its voltage drop calculations
- Illustrate various economic aspects of the power plant erection, operation and different tariff methods
- Understand power factor improvement methods and determine economical power factor

UNIT- I

Thermal Power Stations: Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses. - Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and cooling towers

Gas and Nuclear Power Stations: Nuclear Power Stations: Nuclear Fission and Chain reaction. - Nuclear fuels. - Principle of operation of Nuclear reactor.-Reactor Components: Moderators, Control rods, Reflectors and Coolants. - Radiation hazards: Shielding and Safety precautions. - Types of Nuclear reactors and brief description of PWR, BWR and FBR.

Gas Power Stations: Principle of Operation and Components (Block Diagram Approach Only)

UNIT - II

Hydroelectric Power Stations: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area; heads and efficiencies.

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design - draft tube- theory- functions and efficiency.

UNIT - III

D.C. Distribution Systems: Classification of Distribution Systems.- Comparison of DC vs. AC and Under-Ground vs. Over- Head Distribution Systems.- Requirements and Design features of Distribution Systems.-Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

A.C. Distribution Systems: Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT-IV

Substations: Classification of substations

Air insulated substations - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment.

Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

Gas insulated substations (GIS) – Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-V

Economic Aspects of Power Generation: Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems.

Tariff Methods: Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method.-Tariff Methods: Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods and Numerical Problems

TEXT BOOKS:

1. "C. L. Wadhawa", "Generation and utilization of Electrical Energy", New age International (P) Limited, Publishers 1997.
2. "C. L. Wadhawa", "Electrical Power Systems", New age International (P) Limited, Publishers 1997.
3. "M. L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakraborti", "A Text Book on Power System Engineering", Dhanpat Rai and Co. Pvt. Ltd, 1999.

REFERENCE BOOKS:

1. "M.V. Deshpande", "Elements of Power Station design and practice" , Wheeler Publishing, 3rd Edition 1999.
2. "S. N. Singh", "Electrical Power Generation, Transmission and Distribution", PHI, 2003.
3. "V.K Mehta and Rohit Mehta", "Principles of Power Systems", S. Chand& Company Ltd, New Delhi, 2004.

EE403ES: ELECTRICAL MACHINES – II

B.Tech. II Year II Sem.

L	T	P	C
4	1	0	4

Prerequisite: Electrical Machines-I

Course Objectives:

- To deal with the detailed analysis of polyphase induction motors & Synchronous generators and motors
- To understand operation, construction and types of single phase motors and their applications in house hold appliances and control systems.
- To introduce the concept of parallel operation of synchronous generators.
- To introduce the concept of regulation and its calculations.

Course Outcomes: After this course, the student

- Identify different parts of transformers and induction motors and specify their functions
- Understand the operation of transformers and induction motors
- Carry out different testing methods and assess the performance of transformers and induction motors
- Start and control the induction motor

UNIT – I

Polyphase Induction Motors: Constructional details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation.

UNIT - II

Characteristics of Induction Motors: Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic - equivalent circuit - phasor diagram - crawling and cogging -.No-load Test and Blocked rotor test – Predetermination of performance-Methods of starting and starting current and Torque calculations.

Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT – II

Construction, Principle of operation, Characteristics & Regulation of Synchronous Generator: Constructional Features of round rotor and salient pole machines – Armature

windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation.
Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.
Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT - IV

Parallel Operation of Synchronous Generator: Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactances.
Synchronous Motors – Principle of Operation: Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed .- hunting and its suppression – Methods of starting – synchronous induction motor.

UNIT - V

Single Phase Motors & Special Motors:: Single phase induction motor – Constructional features-Double revolving field theory – split-phase motors – shaded pole motor.

TEXT BOOKS:

1. "I. J. Nagrath & D. P. Kothari", "Electric Machines", Tata Mc Graw Hill, 7th Edition, 2009
2. "PS Bhimbra", "Electrical machines", Khanna Publishers, 2014

REFERENCE BOOKS:

1. "M. G. Say", "Performance and Design of AC Machines", CBS Publishers, 3rd Edition, 2002.
2. "A.E. Fitzgerald, C. Kingsley and S. Umans", "Electric machinery", Mc Graw Hill Companies, 7th edition, 2013
3. "Langsdorf", "Theory of Alternating Current Machinery", Tata McGraw-Hill Companies, 2nd edition, 1984.
4. "M.V Deshpande", "Electrical Machines", Wheeler Publishing, 2011

EE404ES: CONTROL SYSTEMS

B.Tech. II Year II Sem.

L	T	P	C
4	1	0	4

Prerequisite: Ordinary Differential Equations & Laplace Transform, Mathematics I

Course objectives:

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance

Course outcomes: After completion of this course the student is able to

- Improve the system performance by selecting a suitable controller and/or a compensator for a specific application
- Apply various time domain and frequency domain techniques to assess the system performance
- Apply various control strategies to different applications (example: Power systems, electrical drives etc…)
- Test system Controllability and Observability using state space representation and applications of state space representation to various systems.

UNIT – I

Introduction: Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations - Impulse Response and transfer functions - Translational and Rotational mechanical systems.

Transfer Function Representation: Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples - Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.

UNIT-II

Time Response Analysis: Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT – III

Stability Analysis: The concept of stability - Routh stability criterion – qualitative stability and conditional stability.

Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

Frequency Response Analysis: Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

UNIT - IV

Stability Analysis In Frequency Domain: Polar Plots, Nyquist Plots and applications of Nyquist criterion to find the stability - Effects of adding poles and zeros to G(s)H(s) on the shape of the Nyquist diagrams.

Classical Control Design Techniques: Compensation techniques – Lag, Lead, and Lead-Lag Controllers design in frequency Domain, PID Controllers.

UNIT – V

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties.

TEXT BOOKS:

1. "I. J. Nagrath and M. Gopal", "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009
2. "B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

REFERENCE BOOKS:

1. "N. K. Sinha", "Control Systems", New Age International (P) Limited Publishers, 3rd Edition, 1998.
2. "NISE", "Control Systems Engineering", John wiley, 6th Edition, 2011.
3. "Katsuhiko Ogata", "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

SM405ES: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Objective: To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcome: The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

UNIT – I

Introduction to Business and Economics:

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II

Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT- III

Production, Cost, Market Structures & Pricing:

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT - IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems). Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.

REFERENCES:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

EE406ES: CONTROL SYSTEMS LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

Prerequisite: Control Systems

Course Objectives:

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance

Course Outcomes: After completion of this lab the student is able to

- How to improve the system performance by selecting a suitable controller and/or a compensator for a specific application
- Apply various time domain and frequency domain techniques to assess the system performance
- Apply various control strategies to different applications(example: Power systems, electrical drives etc)
- Test system controllability and observability using state space representation and applications of state space representation to various systems

The following experiments are required to be conducted compulsory experiments:

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC motor
6. Transfer function of DC generator
7. Temperature controller using PID
8. Characteristics of AC servo motor

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

9. Effect of P, PD, PI, PID Controller on a second order systems
10. Lag and lead compensation – Magnitude and phase plot

11. (a) Simulation of P, PI, PID Controller.
    b) Linear system analysis (Time domain analysis, Error analysis) using suitable software
12. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using suitable software
13. State space model for classical transfer function using suitable software -Verification.
14. Design of Lead-Lag compensator for the given system and with specification using suitable software

REFERENCE BOOKS

- Manuals of related software.

EE407ES: ELECTRICAL MACHINES LAB – II

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

Prerequisite: Electrical Machines – I & Electrical Machines - II

Course Objectives:

- To understand the operation of synchronous machines
- To understand the analysis of power angle curve of a synchronous machine
- To understand the equivalent circuit of a single phase transformer and single phase induction motor
- To understand the circle diagram of an induction motor by conducting a blocked rotor test.

Course Outcomes: After the completion of this laboratory course, the student will be able

- Assess the performance of different machines using different testing methods
- To convert the Phase from three phase to two phase and vice versa
- Compensate the changes in terminal voltages of synchronous generator after estimating the change by different methods
- Control the active and reactive power flows in synchronous machines
- Start different machines and control the speed and power factor

The following experiments are required to be conducted as compulsory experiments

1. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner's test on a pair of single phase transformers
3. No-load & Blocked rotor tests on three phase Induction motor
4. Regulation of a three –phase alternator by synchronous impedance &m.m.f. methods
5. V and Inverted V curves of a three—phase synchronous motor.
6. Equivalent Circuit of a single phase induction motor
7. Determination of Xd and Xq of a salient pole synchronous machine
8. Load test on three phase Induction Motor

In addition to the above experiments, at least any two of the following experiments are required to be conducted from the following list

1. Separation of core losses of a single phase transformer
2. Efficiency of a three-phase alternator
3. Parallel operation of Single phase Transformers
4. Regulation of three-phase alternator by Z.P.F. and A.S.A methods
5. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers
6. Measurement of sequence impedance of a three-phase alternator.
7. Vector grouping of Three Transformer

8. Scott Connection of transformer

EE408ES: ELECTRONIC CIRCUITS LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

Prerequisite: Electronic Circuits& Switching theory and Logic Design

Course Objectives:

- To design and simulate various BJT and FET Voltage and Power amplifiers.
- To design and simulate various BJT Feedback amplifiers.
- To design and simulate various BJT Oscillators.
- To design and simulate linear and non linear wave shaping circuits

Course Outcomes: After completion of this lab the student is able to

- Apply the concepts of amplifiers in the design of Public Addressing System
- Generate Sinusoidal wave forms
- Design stable system using feedback concepts.
- Design multi vibrator using transistor

The following experiments are required to be conducted compulsory experiments:

1. CE amplifier.
2. CC amplifier (Emitter Follower).
3. FET amplifier (Common Source).
4. Wien bridge and RC Phase shift Oscillator.
5. Current series and Voltage series Feedback Amplifier.
6. Colpitt and Hartley Oscillator.
7. Double stage RC coupled amplifier.
8. Clippers and Clampers

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

9. Transistor as a switch
10. Study of Logic gates & some applications
11. Study of Flip-Flops and some applications.
12. Monostable &A stable multivibrators.
13. Bistable multivibrator & Schmitt trigger**.**

MC400HS: GENDER SENSITIZATION LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	0

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT - I
UNDERSTANDING GENDER

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT - II
GENDER AND BIOLOGY:

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many? Struggles with Discrimination.

UNIT - III
GENDER AND LABOUR

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV
ISSUES OF VIOLENCE

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu*".
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.
Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT - V
GENDER: CO - EXISTENCE

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXTBOOK

All the five Units in the Textbook***, "Towards a World of Equals: A Bilingual Textbook on Gender"*** written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu and published by **Telugu Akademi, Hyderabad**,Telangana State in the year **2015**.

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

REFERENCE BOOKS:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. "*I Fought For My Life…and Won*."Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

EE501PC: ELECTRICAL MEASUREMENTS & INSTRUMENTATION

B.Tech. III Year I Sem.

L	T	P	C
4	1	0	4

Pre-requisite: Basic Electrical and Electronics Engineering, Network theory & Electromagnetic fields.

Course objectives:

- To introduce the basic principles of all measuring instruments
- To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.

Course Outcomes: After completion of this course, the student

- Understand different types of measuring instruments, their construction, operation and characteristics
- Identify the instruments suitable for typical measurements
- Apply the knowledge about transducers and instrument transformers to use them effectively.

UNIT- I

Introduction to Measuring Instruments: Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – extension of range of E.S. Voltmeters.

UNIT– II

Potentiometers & Instrument transformers: Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications. CT and PT – Ratio and phase angle errors

UNIT –III

Measurement of Power & Energy: Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems.

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using R.S.S. meter. Three phase energy meter – tri-vector meter, maximum demand meters.

UNIT – IV

DC & AC bridges: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method.

Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge - Owen's bridge. Measurement of capacitance and loss angle –Desaunty's Bridge - Wien's bridge – Schering Bridge.

UNIT-V

Transducers: Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes.

Measurement of Non-Electrical Quantities: Measurement of strain, Gauge sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow and Liquid level.

TEXT BOOKS:

1. "G. K. Banerjee", "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016
2. "S. C. Bhargava", "Electrical Measuring Instruments and Measurements", BS Publications, 2012.

REFERENCE BOOKS:

1. "A. K. Sawhney", "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2005.
2. "R. K. Rajput", "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
3. "Buckingham and Price", "Electrical Measurements", Prentice – Hall, 1988.
4. "Reissland, M. U", "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
5. "E.W. Golding and F. C. Widdis", "Electrical Measurements and measuring Instruments", fifth Edition, Wheeler Publishing, 2011.

EE502PC: POWER SYSTEMS - II

B.Tech. III Year I Sem.

L	T	P	C
4	1	0	4

Prerequisite: Power Systems –I and Electromagnetic field theory

Course Objectives:

- To compute inductance and capacitance of different transmission lines.
- To understand performance of short, medium and long transmission lines.
- To examine the traveling wave performance and sag of transmission lines.
- To design insulators for over head lines and understand cables for power transmission.

Course Outcomes: After completion of this course, the student

- Able to compute inductance and capacitance for different configurations of transmission lines.
- Able to analyze the performance of transmission lines
- Can understand transient's phenomenon of transmission lines.
- Able to calculate sag and tension calculations.
- Will be able to understand overhead line insulators and underground cables.

UNIT-I

Transmission Line Parameters: Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems.

Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT-II

Performance of Short and Medium Length Transmission Lines: Classification of Transmission Lines - Short, medium and long line and their model representations - Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems. Mathematical Solutions to estimate regulation and efficiency of all types of lines - Numerical Problems.

Performance of Long Transmission Lines: Long Transmission Line - Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, Incident, Reflected and Refracted Waves -Surge Impedance and SIL of Long Lines, Wave Length and Velocity of Propagation of Waves - Representation of Long Lines - Equivalent-T and Equivalent Pie network models (numerical problems).

UNIT – III

Power System Transients: Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems), Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

Various Factors Governing The Performance of Transmission Line: Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect - Charging Current - Effect on Regulation of the Transmission Line.

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

UNIT-IV

Overhead Line Insulators: Types of Insulators, String efficiency and Methods for improvement, Numerical Problems - voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

Sag and Tension Calculations: Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

UNIT-V

Underground Cables: Types of Cables, Construction, Types of Insulating materials, Calculation of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables - Capacitance grading - Numerical Problems, Description of Inter-sheath grading - HV cables.

TEXT BOOKS:

1. "C. L. Wadhwa", "Electrical power systems", New Age International (P) Limited Publishers, 1998.
2. "Grainger and Stevenson", "Power Systems Analysis", Mc Graw Hill, 1st Edition 2003.
3. "M. L. Soni, P. V. Gupta, U.S. Bhatnagar and A. Chakrabarthy", Power System Engineering, Dhanpat Rai & Co Pvt. Ltd, 2009.

REFERENCE BOOKS:

1. "I. J. Nagarath & D. P Kothari" , "Power System Engineering", TMH, 2nd Edition 2010
2. "B. R. Gupta", "Power System Analysis and Design", Wheeler Publishing, 1998.
3. "Abhijit Chakrabarti and Sunitha Halder", "Power System Analysis Operation and control", PHI, 3rd Edition, 2010

EI503PC: MICROPROCESSORS AND MICROCONTROLLERS

B.Tech. III Year I Sem.

L	T	P	C
4	1	0	4

Course Objectives:

- To develop an understanding of the operations of microprocessors and micro controllers; machine language programming and interfacing techniques.

Course Outcomes:

- Understands the internal architecture and organization of 8086, 8051 and ARM processors/controllers.
- Understands the interfacing techniques to 8086 and 8051 and can develop assembly language programming to design microprocessor/ micro controller based systems.

UNIT - I

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT - II

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

UNIT – III

I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

UNIT – IV

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V

Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed.
3. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

REFERENCE BOOKS:

1. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.
2. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.

SM504MS: FUNDAMENTALS OF MANAGEMENT

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills.

Course Outcome: The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

UNIT - I

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT - II

Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy. Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT - III

Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.

Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT - IV

Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.

Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT - V

Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency, and Methods.

TEXT BOOKS:

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES:

1. Essentials of Management, Koontz Kleihrich, Tata McGraw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012

EE505PC: ELECTRICAL MEASUREMENTS & INSTRUMENTATION LAB

B.Tech. III Year I Sem.

L	T	P	C
0	0	3	2

Course Objectives:

- To calibrate LPF Watt Meter, energy meter, P. F Meter using electro dynamo meter type instrument as the standard instrument
- To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges & A. C Bridges
- To determine three phase active & reactive powers using single wattmeter method practically
- To determine the ratio and phase angle errors of current transformer and potential transformer.

Course Outcomes: After completion of this lab the student is able to

- to choose instruments
- test any instrument
- find the accuracy of any instrument by performing experiment
- calibrate PMMC instrument using D.C potentiometer

The following experiments are required to be conducted as compulsory experiments

1. Calibration and Testing of single phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering bridge & Anderson bridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

9. Calibration LPF wattmeter – by Phantom testing.
10. Measurement of 3-phase power with single watt meter and two CTs.

11. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
12. PT testing by comparison **– V. G.** as Null detector – Measurement of % ratio error and phase angle of the given PT
13. Resistance strain gauge – strain measurements and Calibration.
14. Transformer turns ratio measurement using AC bridges.
15. Measurement of % ratio error and phase angle of given CT by comparison.

EE506PC: BASIC ELECTRICAL SIMULATION LAB

B.Tech. III Year I Sem.

L	T	P	C
0	0	3	2

Prerequisite: Basic Electrical and Electronics Engineering & Network Theory.

Course Objectives:

- To develop the simulation skills.
- To generate various signals and synthesis for the engineering systems.
- To analyze harmonics in the systems.
- To analyze electrical circuit in simulation environment.

Course Outcomes: After going through this lab the student will be able to

- Apply signal generation in different systems.
- Analyze networks by various techniques
- Analyze circuit responses
- Analyze bridge rectifiers

The following experiments are required to be conducted compulsory experiments:

1. Basic Operations on Matrices
2. Generation of various signals and sequences (Periodic and Aperiodic), such as unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power
4. Mesh and Nodal Analysis of Electrical circuits
5. Application of Network Theorems to Electrical Networks
6. Waveform Synthesis using Laplace Transform
7. Locating the Zeros and Poles and Plotting the Pole-Zero maps in S plane and Z-Plane for the given transfer function
8. Harmonic analysis of non sinusoidal waveforms

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted.

9. Simulation of DC Circuits
10. Transient Analysis
11. Measurement of active Power of three phase circuit for balanced and unbalanced load

12. Simulation of single phase diode bridge rectifiers with filter for R & RL load
13. Simulation of three phase diode bridge rectifiers with R, RL load
14. Design of Low Pass and High Pass filters
15. Finding the Even and Odd parts of Signal / Sequence and Real and imaginary parts of Signal
16. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum

EI507PC: MICROPROCESSORS AND MICROCONTROLLERS LAB

B.Tech. III Year I Sem.	L	T	P	C
	0	0	3	2

Note: - Minimum of 12 experiments to be conducted.
The following programs/experiments are to be written for assembler and to be executed the same with 8086 and 8051 kits.

List of Experiments:

1. Programs for 16 bit arithmetic operations 8086(using various addressing modes)
2. Programs for sorting an array for 8086.
3. Programs for searching for a number of characters in a string for 8086.
4. Programs for string manipulation for 8086.
5. Programs for digital clock design using 8086.
6. Interfacing ADC and DAC to 8086.
7. Parallel communication between two microprocessor kits using 8255.
8. Serial communication between two microprocessor kits using 8251.
9. Interfacing to 8086 and programming to control stepper motor.
10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
11. Program and verify Timer/Counter in 8051.
12. Program and verify interrupt handling in 8051.
13. UART operation in 8051.
14. Communication between 8051 kit and PC
15. Interfacing LCD to 8051
16. Interfacing Matrix/Keyboard to 8051
17. Data transfer from peripheral to memory through DMA controller 8237/8257

MC500HS: PROFESSIONAL ETHICS

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	0

Course Objective: To enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

Course Outcome: The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

UNIT - I

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT - II

Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT - III

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT - IV

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

UNIT - V

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

REFERENCES:

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

EE601PC: POWER SYSTEMS ANALYSIS

B.Tech. III Year II Sem.

L	T	P	C
4	1	0	4

Prerequisite: Power Systems-I & Power Systems –II

Course Objectives:

- To understand and develop Y_{bus} and Z_{bus} matrices
- To know the importance of load flow studies and its importance
- To analyse various types of short circuits
- To know rotor angle stability of power systems

Course Outcomes: After this course, the student will be able to

- Develop the Y_{bus} and Z_{bus} matrices
- Analyze load flow for various requirements of the power system
- Analyze short circuit studies for the protection of power system
- Estimate stability and instability in power systems

UNIT - I

Power System Network Matrices: Graph Theory: Definitions and Relevant concepts in Graph Theory, Network Matrices. Transmission Network Representations: Bus Admittance frame and Bus Impedance frame. Formation of Y_{bus}: Direct and Singular Transformation Methods, Numerical Problems. Formation of Z_{Bus}: Modification of existing Z_{Bus} Matrix for addition of a new branch, & complete Z_{Bus} building algorithm Numerical Problems.

UNIT – II

Power Flow Studies – I: Introduction: Necessity of Power Flow Studies, Bus classification and Notations, Convergence & Bus mismatch criteria. Load Flow Methods: Gauss-Seidal Method in complex form without & with voltage control buses, line flows and loss calculations, Newton Raphson method in Polar and Rectangular form, derivation of Jacobian elements, Numerical Problems for one or two iterations.

UNIT – III

Power Flow Studies - II: Introduction to sensitivity & decoupled sub matrices of J-matrix, Decoupled load flow method and its assumptions, Fast Decoupled load method and its assumptions, Comparison of Different Methods – DC load Flow method, Numerical problems for one or two iterations.

UNIT – IV

Short Circuit Analysis: Per-Unit Systems. Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems. Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems. Symmetrical Components, sequence impedances and networks, Numerical Problems. Unsymmetrical Fault Analysis: Fault current calculations for LG, LL, LLG faults with and without fault impedance, Numerical Problems.

UNIT – V

Power System Stability Analysis: Introduction to Power System Stability issues. Rotor dynamics & Swing equation, Power angle equation with & without neglecting line resistance, Steady State Stability, Determination of Transient Stability through Equal Area Criterion for single machine infinite system, Critical clearing angle & time, Numerical problems. Multi-machine transient analysis: Classical representation of system and its assumptions, Solution of Swing Equation by Point-by-Point Method, Methods to improve Stability.

TEXT BOOKS:

1. "I. J. Nagrath & D. P. Kothari", "Modern Power system Analysis", Tata McGraw-Hill Publishing Company, 4th Edition 2011.
2. "Hadi Saadat", "Power System Analysis", TMH Edition, 2002.

REFERENCE BOOKS:

1. "M. A. Pai", "Computer Techniques in Power System Analysis", TMH Publications, 3rd Edition 2014.
2. Grainger and Stevenson, "Power System Analysis", Tata McGraw Hill, 2003.
3. Abhijit Chakrabarthi and Sunita Haldar, "Power System Analysis Operation and Control", 3rd Edition, PHI, 2010.

EE602PC: POWER ELECTRONICS

B.Tech. III Year II Sem.

L	T	P	C
4	1	0	4

Prerequisite: Electronic circuits

Course Objectives:

- To Design/develop suitable power converter for efficient control or conversion of power in drive applications
- To Design / develop suitable power converter for efficient transmission and utilization of power in power system applications.

Course Outcomes: After completion of this course the student is able to

- Choose the appropriate converter for various applications
- Design the power converters suitable for particular applications
- Develop the novel control methodologies for better performance.

UNIT – I

Power Semi Conductor Devices and Commutation Circuits: Thyristors - Silicon Controlled Rectifiers (SCR's) - BJT - Power MOSFET - Power IGBT and their characteristics and other thyristors - Basic theory of operation of SCR - Static characteristics – Turn-on and Turn-off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points.

Two transistor analogy of SCR - R, RC, UJT firing circuits - Series and parallel connections of SCRs - Snubber circuit details – Specifications and Ratings of SCR, BJT, IGBT - Numerical problems – Line Commutation and Forced Commutation circuits.

UNIT – II

Single Phase Half Wave Controlled Converters: Phase control technique - Single phase Line commutated converters - Half wave controlled converters with Resistive, RL load and RLE load - Derivation of average load voltage and current -Active and Reactive power inputs to the converters without and with Freewheeling Diode - Numerical problems

Single Phase Fully Controlled Converters: Fully controlled converters, Midpoint and Bridge connections with Resistive, RL loads and RLE load - Derivation of average load voltage and current – Line commutated inverters, semi-converters, active and Reactive power inputs to the converters, Effect of source inductance – Expressions of load voltage and current - Numerical problems.

Three Phase Line Commutated Converters: Three phase converters - Three pulse and six pulse converters and bridge connections with R, RL load voltage and current with R and RL load and RLE loads - Semi Converters, Effect of Source inductance–Dual converters Waveforms - Numerical Problems

UNIT – III

AC Voltage Controllers: AC voltage controllers – Single phase two SCR's in anti parallel with R and RL loads , modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage, current and power factor- wave forms , Numerical problems- Single phase and three phase cycloconverters (principle of operation only).

UNIT – IV

Choppers: Choppers – Time ratio control and Current limit control strategies – Step down choppers- Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper – load voltage expression.

Morgan's chopper – Jones chopper - Oscillation choppers (Principle of operation only) - waveforms — AC Chopper – Problems

UNIT – V

Inverters: Inverters – Single phase inverter – Basic series inverter, parallel Capacitor inverter, bridge inverter – Waveforms,. Simple bridge inverters, Voltage control techniques for inverters- Pulse width modulation techniques – Numerical problems.

TEXT BOOKS:

1. M. D. Singh & K. B. Kanchandhani, "Power Electronics", Tata Mc Graw – Hill Publishing Company, 1998.
2. "M. H. Rashid", "Power Electronics : Circuits, Devices and Applications", Prentice Hall of India, 2nd edition, 1998
3. "V. R. Murthy", "Power Electronics", Oxford University Press, 1st Edition 2005.

REFERENCE BOOKS:

1. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, Publishers, 2nd Edition 2008.
2. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, 1997.
3. M. S. Jamil Asghar, "Power Electronics", PHI Private Limited, 2004.
4. P. C. Sen, "Power Electronics", Tata Mc Graw-Hill Publishing, 2001.
5. John G. Kassakian, Martin, F. Schlect, Geroge C. Verghese, "Principles of Power Electronics", Pearson Education, 1st Edition 2010.

EE603PC: SWITCH GEAR AND PROTECTION

B.Tech. III Year II Sem.

L	T	P	C
4	1	0	4

Prerequisite: Power Systems - I & Power Systems - II

Course Objectives:

- To introduce all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from Over voltages and other hazards.
- To describe neutral grounding for overall protection.
- To understand the phenomenon of Over Voltages and it's classification.

Course Outcomes: After Completion of this course student will be able to

- Understand the types of Circuit breakers and choice of Relays for appropriate protection of power system equipment.
- Understand various types of Protective devices in Electrical Power Systems.
- Interpret the existing transmission voltage levels and various means to protect the system against over voltages.
- Understand the importance of Neutral Grounding, Effects of Ungrounded Neutral grounding on system performance, Methods and Practices.

UNIT - I

Introduction to Circuit Breakers: Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.- Restriking Phenomenon, Average and Maximum RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto-reclosures.

Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum, and SF6 circuit breakers.

UNIT – II

Electromagnetic and Static Relays: Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc and Induction Cup relays.

Types of Over Current Relays: Instantaneous, DMT and IDMT types.

Application of relays: Over current/ under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays.

Universal torque equation, Distance relays: Impedance, Reactance, and Mho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison. Static Relays: Static Relays verses Electromagnetic Relays.

UNIT – III

Protection of Power Equipment: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected.

Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT s Ratio, Buchholtz relay Protection.

Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay.

Protection of Bus bars – Differential protection.

UNIT – IV

Neutral Grounding: Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices.

UNIT - V

Protection Against Overvoltages: Generation of Over Voltages in Power Systems.- Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination -BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time Characteristics.

TEXT BOOKS:

1. “Badri Ram , D. N Viswakarma”, “Power System Protection and Switchgear”, TMH Publications, 2011
2. “Sunil S Rao”, “Switchgear and Protection”, Khanna Publishers, 2008.

REFERENCE BOOKS:

1. “Paithankar and S. R. Bhide”, “Fundamentals of Power System Protection”, PHI, 2003.
2. “C R Mason”, Art & Science of Protective Relaying – Wiley Eastern Ltd, 1966.
3. “C. L. Wadhwa”, “Electrical Power Systems”, New Age international (P) Limited, Publishers, 6th Edition 2007

EM611PE: COMPUTER ORGANIZATION
(PROFESSIONAL ELECTIVE – I)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Switching theory and Logic Design

Course Objectives:

- To understand basic components of computers.
- To understand the architecture of 8086 processor.
- To understand the instruction sets, instruction formats and various addressing modes of 8086.
- To understand the representation of data at the machine level and how computations are performed at machine level.
- To understand the memory organization and I/O organization.
- To understand the parallelism both in terms of single and multiple processors.

Course Outcomes:

- Able to understand the basic components and the design of CPU, ALU and Contr**ol** Unit.
- Ability to understand memory hierarchy and its impact on computer cost/performance.
- Ability to understand the advantage of instruction level parallelism and pipelining for high performance Processor design.
- Ability to understand the instruction set, instruction formats and addressing modes of 8086.
- Ability to write assembly language programs to solve problems.

UNIT - I

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Basic Computer Organization and Design: Instruction codes, Computer Registers, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, Complete Computer Description.

Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

UNIT - II

Central Processing Unit: The 8086 Processor Architecture, Register organization, Physical memory organization, General Bus Operation, I/O Addressing Capability, Special Processor Activities, Minimum and Maximum mode system and timings.

8086 Instruction Set and Assembler Directives-Machine language instruction formats, Addressing modes, Instruction set of 8086, Assembler directives and operators.

UNIT - III

Assembly Language Programming with 8086- Machine level programs, Machine coding the programs, Programming with an assembler, Assembly Language example programs.

Stack structure of 8086, Interrupts and Interrupt service routines, Interrupt cycle of 8086, Interrupt programming, Passing parameters to procedures, Macros, Timings and Delays.

UNIT - IV

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating - point Arithmetic operations.

Input-Output Organization: Peripheral Devices**,** Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input –Output Processor (IOP),Intel 8089 IOP.

UNIT - V

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Inter processor arbitration, Inter processor communication, and synchronization.

TEXT BOOKS:

1. Computer System Architecture, M. Moris Mano, Third Edition, Pearson. **(UNIT-I , IV , V)**
2. Advanced Microprocessors and Peripherals, K M Bhurchandi, A.K Ray ,3rd edition, McGraw Hill India Education Private Ltd. **(UNITS - II, III).**

REFERENCES:

1. Microprocessors and Interfacing, D V Hall, SSSP Rao, 3rd edition, McGraw Hill India Education Private Ltd.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002
3. Computer Organization and Architecture, William Stallings, 9th Edition, Pearson.
4. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.

EE612PE: LINEAR SYSTEMS ANALYSIS (PROFESSIONAL ELECTIVE – I)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics – II & Network Theory

Course Objectives:

- To develop ability to analyze linear systems and signals
- To develop critical understanding of mathematical methods to analyze linear systems and signals

Course Outcomes: After successfully completing this course, students will be able to:

1. Use mathematical modeling tools to represent linear systems
2. Use mathematical modeling tools to analyze linear systems

UNIT-I

State Variable Analysis: Choice of state variables in Electrical networks-Formulation of state equations for Electrical networks Equivalent source method. Network topological method - Solution of state equations-Analysis of simple networks with state variable approach.

UNIT–II

Fourier Series and Fourier Transform Representation: Introduction, Trigonometric form of Fourier series, Exponential form of Fourier series, Wave symmetry, Fourier integrals and transforms, Fourier transform of a periodic function , Properties of Fourier Transform , Parseval's theorem , Fourier transform of some common signals, Fourier transform relationship with Laplace Transform.

Applications of Fourier series and Fourier Transform Representation: Introduction, Effective value, and average values of non sinusoidal periodic waves, currents, Power Factor, Effects of harmonics, Application in Circuit Analysis, Circuit Analysis using Fourier Series.

UNIT – III

Laplace Transform Applications: Application of Laplace transform Methods of Ananlysis – Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions, Shifting Theorem – Convolution Integral – Applications

Testing of Polynomials: Elements of realisability - Hurwitz polynomials-positive real functions-Properties-Testing-Sturm's Test, examples.

Network Synthesis: Network synthesis: Synthesis of one port LC networks-Foster and Cauer methods-Synthesis of RL and RC one port networks-Foster and Cauer methods

UNIT-IV

Sampling: Sampling theorem – Graphical and Analytical proof for Band Limited Signal impulse sampling, natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, introduction to Band Pass sampling, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and Energy / Power spectral density function.

UNIT-V

Z-Transforms: Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z Transform of a discrete sequence. Distinction between Laplace, Fourier, and Z-Transforms. Region of convergence in Z-Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z-Transforms.

Text Books:

1. "B. P. Lathi", "Signals, Systems and Communications", BS Publications 2003.
2. "Umesh Sinha" "Network Analysis and Synthesis", Satya Prakashan Publications, 2013.

Reference Books:

1. "A. N. Tripathi", "Linear System Analysis", New Age International, 2nd Edition 1987.
2. "D. Roy Chowdhary", "Network and Systems", New Age International, 2005.
3. "Gopal G Bhise, Prem R. Chadha", Engineering Network Analysis and Filter Design, Umesh Publications 2009.
4. "A. Cheng", linear system analysis, Oxford publishers, 1999.

EE613PE: LINEAR AND DIGITAL IC APPLICATIONS (PROFESSIONAL ELECTIVE – I)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electronic circuits & Digital logic fundamentals

Course Objectives: The main objectives of the course are:

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non - linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To teach the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs.
- To understand and implement the working of basic digital circuits

Course Outcomes: On completion of this course, the students will have:

- A thorough understanding of operational amplifiers with linear integrated circuits.
- Understanding of the different families of digital integrated circuits and their characteristics.
- Also students will be able to design circuits using operational amplifiers for various applications.

UNIT - I

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT - II

Op-Amp, IC-555 & IC 565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

UNIT - III

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT - IV

Digital Integrated Circuits: Classification of Integrated Circuits, Comparison of Various Logic Families, CMOS Transmission Gate, IC interfacing- TTL Driving CMOS & CMOS Driving TTL, Combinational Logic ICs – Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers , Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT - V

Sequential Logic ICs and Memories: Familiarity with commonly available 74XX & CMOS 40XX Series ICs – All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers**.**

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXT BOOKS:

1. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.
2. Operational Amplifiers - George Clayton and Steve Winder, 5th Ed, Elsevier

REFERENCE BOOKS:

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.
2. Modern Digital Electronics – RP Jain – 4/e – TMH, 2010.
3. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005
4. Digital Design Principles and Practices – John. F. Wakerly 3/e, 2005.
5. Operational Amplifiers with Linear Integrated Circuits, 4/e William D. Stanley, Pearson Education India, 2009.

EE614PE: ELECTRICAL AND ELECTRONICS INSTRUMENTATION (PROFESSIONAL ELECTIVE – I)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Measurements & Instrumentation

Course Objectives:

- Instrumentation is essential in monitoring and analysis of any Physical system and its control.
- This course deals with different types of transducers, digital voltmeters, oscilloscopes, and measurement of non electrical quantities.

Course Outcomes: After completion of this course, the student will be able to

- Design and implement systems utilizing analog / digital control devices.
- Apply the concepts of automatic control, including measurement, feedback, and feed forward regulation for the operation of continuous and discrete systems.
- Solve technical problems and be proficient in the analysis, design, test, and implementation of instrumentation and control systems.
- Apply the concepts of heat transfer to the design of process control systems.
- Able to utilize modern and effective management skills for performing investigation, analysis, and synthesis in the implementation of automatic control systems.

UNIT – I

Characteristics of Signals and Their Representation: Measuring Systems, Performance Characteristics - Static characteristics, Dynamic Characteristics; Errors in Measurement - Gross Errors, Systematic Errors, Statistical Analysis of Random Errors.

Signals and their representation: Standard Test, periodic, aperiodic, modulated signal, sampled data, pulse modulation, and pulse code modulation

UNIT – II

Oscilloscope and Digital Voltmeters: Cathode ray oscilloscope-Cathode ray tube-time base generator - horizontal and vertical amplifiers - CRO probes-applications of CRO - Measurement of phase and frequency - lissajous patterns - Sampling oscilloscope-analog and digital type.

Digital voltmeters - Successive approximation, ramp, dual-Slope integration, continuous balance type - Micro processor based ramp type DVM, digital frequency meter - digital phase angle meter.

UNIT – III

Signal Analyzers: Wave analyzers - Frequency selective analyzers, Heterodyne, Application of Wave analyzers - Harmonic Analyzers, Total Harmonic distortion, spectrum analyzers, Basic spectrum analyzers, spectral displays, vector impedance meter, Q meter. Peak reading and RMS voltmeters.

UNIT – IV

Transducers: Definition of transducers, Classification of transducers, Advantages of electrical transducers, Characteristics and choice of transducers; Principle of operation of resistor, inductor, LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Synchros, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes.

UNIT – V

Measurement of Non-Electrical Quantities: Measurement of strain, Gauge sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow and Liquid level.

Text Books:

1. D. V. S Murthy, "Transducers and Instrumentation", Prentice Hall of India, 2nd edition, 2009.
2. K. Sawhney, "A course in Electrical and Electronic Measurements and Instrumentation", Dhanpatrai & Co., 12th edition, 2010.

Reference Books:

1. D O Doeblin, "Measurements Systems, Applications and Design", TMH Publications, 5th edition, 2003.
2. D Helfrick and W. D. Cooper, "Modern Electronic Instrumentation and Measurement techniques", Pearson/Prentice Hall of India, 12th edition, 2010.
3. S Morris, "Principles of Measurement and Instrumentation", Pearson /Prentice Hall of India, 2nd edition, 1994.
4. H. S. Kalsi, "Electronic Instrumentation", Tata McGraw-Hill Edition, 1995, 1st edition, 1995.

EE604PC: POWER SYSTEMS LAB

B.Tech. III Year II Sem.

L	T	P	C
0	0	3	2

Prerequisite: Power Systems & Electrical Machines

Course Objectives:

- perform testing of CT, PT's and Insulator strings
- To find sequence impedances of 3-Φ synchronous machine and Transformer
- To perform fault analysis on Transmission line models and Generators.

Course Outcomes: After completion of this lab, the student will be able to

- Perform various load flow techniques
- Understand Different protection methods
- Analyze the experimental data and draw the conclusions**.**

The following experiments are required to be conducted as compulsory experiments:

Part - A

1. Characteristics of IDMT Over Current Relay.
2. Differential protection of 1-Φ transformer.
3. Characteristics of Micro Processor based Over Voltage/Under Voltage relay.
4. Testing of CT, PT's and Insulator strings.
5. Finding the sequence impedances of 3-Φ synchronous machine.
6. Finding the sequence impedances of 3-Φ Transformer.

In addition to the above six experiments, at least any four of the experiments from the following list are required to be conducted.

Part - B

1. Formation of Y_{BUS}.
2. Load Flow Analysis using Gauss Seidal (GS) Method.
3. Load Flow Analysis using Fast Decoupled (FD) Method.
4. Formation of Z_{BUS}.
5. LG, LL and 3-Φ fault analysis of 3-Φ synchronous machine.
6. Power circle diagrams of a 3-Φ transmission line model.

7. ABCD constants and Regulation of a 3-Φ transmission line model.
8. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point method.

Reference Books:

1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub. Co., 2001.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.
3. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 2003.

EE605PC: POWER ELECTRONICS LAB

B.Tech. III Year II Sem.

L	T	P	C
0	0	3	2

Prerequisite: Power Electronics

Course Objectives:

- Apply the concepts of power electronic converters for efficient conversion/control of power from source to load.
- Design the power converter with suitable switches meeting a specific load requirement.

Course Outcomes: After completion of this course, the student is able to

- Understand the operating principles of various power electronic converters.
- Use power electronic simulation packages& hardware to develop the power converters.
- Analyze and choose the appropriate converters for various applications

Any eight experiments should be conducted

1. Study of Characteristics of SCR, MOSFET & IGBT,
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase half controlled &fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. Single Phase Cycloconverter with R and RL loads
7. Single Phase series& parallel inverter with R and RL loads
8. Single Phase Bridge inverter with R and RL loads

Any two experiments should be conducted

9. DC Jones chopper with R and RL Loads
10. Three Phase half controlled bridge converter with R-load
11. Single Phase dual converter with RL loads
12. (a)Simulation of single-phase Half wave converter using R and RL loads

    (b)Simulation of single-phase full converter using R, RL and RLE loads

(c)Simulation of single-phase Semi converter using R, RL and RLE loads

13. (a)Simulation of Single-phase AC voltage controller using R and RL loads

    (b)Simulation of Single phase Cyclo-converter with R and RL-loads

14. Simulation of Buck chopper
15. Simulation of single phase Inverter with PWM control
16. Simulation of three phase fully controlled converter with R and RL loads, with and without freewheeling diode. Observation of waveforms for Continuous and Discontinuous modes of operation.
17. Study of PWM techniques

Reference Books:

1. M. H. Rashid, Simulation of Electric and Electronic circuits using PSPICE – by M/s PHI Publications.
2. User's manual of related softwares
3. Reference guides of related softwares
4. Rashid, Spice for power electronics and electric power, CRC Press

EN606HS: ADVANCED ENGLISH COMMUNICATION SKILLS LAB

B.Tech. III Year II Sem.

L	T	P	C
0	0	3	2

Introduction

A course on *Advanced English Communication Skills (AECS) Lab* is considered essential at the third year level of B.Tech and B.Pharmacy courses. At this stage, the students need to prepare themselves for their career which requires them to listen to, read, speak, and write in English both for their professional and interpersonal communication. The main purpose of this course is to prepare the students of Engineering for their placements.

Course Objectives: This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve students' fluency in spoken English
- To enable them to listen to English spoken at normal conversational speed
- To help students develop their vocabulary
- To read and comprehend texts in different contexts
- To communicate their ideas relevantly and coherently in writing
- To make students industry-ready
- To help students acquire behavioral skills for their personal and professional life
- To respond appropriately in different socio-cultural and professional contexts

Course Outcomes: Students will be able to:

- Acquire vocabulary and use it contextually
- Listen and speak effectively
- Develop proficiency in academic reading and writing
- Increase possibilities of job prospects
- Communicate confidently in formal and informal contexts

Syllabus:

The following course activities will be conducted as part of the Advanced English Communication Skills (AECS) Lab:

1. **Inter-personal Communication and Building Vocabulary** - Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations - Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and Collocations.

2. **Reading Comprehension** –General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, Skimming, Scanning, Inferring Meaning.
3. **Writing Skills** – Structure and Presentation of Different Types of Writing – Letter Writing/Resume Writing/ e-correspondence/ Technical Report Writing.
4. **Presentation Skills** – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ e-mails/Assignments etc.,
5. **Group Discussion and Interview Skills** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas and Rubrics of Evaluation - Concept and Process, Pre-interview Planning, Opening Strategies, Answering Strategies, Interview through Tele-conference & Video-conference and Mock Interviews.

Minimum Hardware Requirement:

Advanced English Communication Skills (AECS) Lab shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Eight round tables with five movable chairs for each table.
- Audio-visual aids
- LCD Projector
- Public Address system
- Computer with suitable configuration

Suggested Software: The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 8th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.

References:

1. Kumar, Sanjay, and Pushp Lata. English for Effective Communication, Oxford University Press, 2015.
2. **Konar, Nira,** English Language Laboratories – A Comprehensive Manual, PHI Learning Pvt. Ltd., 2011.

EE701PC: POWER SEMICONDUCTOR DRIVES

B.Tech. IV Year I Sem.

L	T	P	C
4	1	0	4

Prerequisite: Power Electronics & Electrical Machines – I, II

Course Objectives:

- To introduce the drive system and operating modes of drive and its characteristics
- To understand Speed – Torque characteristics of different motor drives by various power converter topologies
- To appreciate the motoring and braking operations of drive
- To differentiate DC and AC drives

Course Outcomes: After completion of this course the student is able to

- Indentify the drawbacks of speed control of motor by conventional methods.
- Differentiate Phase controlled and chopper controlled DC drives speed-torque characteristics merits and demerits
- Understand Ac motor drive speed–torque characteristics using different control strategies its merits and demerits
- Describe Slip power recovery schemes

UNIT – I

Control of DC motors by single phase and three phase converters: Introduction to Thyristor controlled Drives, Single Phase semi and Fully controlled converters connected to d.c separately excited and d.c series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed d.c motors.

Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT – II

Four quadrant operation of DC drives: Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic, and Regenerative Braking operations. Four quadrant operation of D.C motors by single phase and three phase dual converters – Closed loop operation of DC motor (Block Diagram Only)

Control of DC Motors by Choppers: Single quadrant, Two quadrant and four quadrant chopper fed dc separately excited and series motors – Continuous current operation – Output

voltage and current wave forms – Speed and torque expressions – speed-torque characteristics – Problems on Chopper fed D.C Motors – Closed Loop operation (Block Diagram Only)

UNIT - III

Control of Induction Motor Through Stator Voltage And Stator Frequency: Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics.

Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo converters- PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only)

UNIT – IV

Rotor Side Control of Induction Motor: Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages, applications, problems.

UNIT –V

Control of Synchronous Motors: Separate control and self control of synchronous motors – Operation of self controlled synchronous motors by VSI, CSI and cyclo converters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control - Cyclo converter, PWM based VSI& CSI.

Text Books:

1. “G K Dubey”, Fundamentals of Electric Drives, CRC Press, 2002.
2. “Vedam Subramanyam”, Thyristor Control of Electric drives, Tata McGraw Hill Publications, 1987.

Reference Books:

1. “S K Pillai”, A First course on Electrical Drives, New Age International (P) Ltd. 2nd Edition. 1989
2. “P. C. Sen”, Thyristor DC Drives, Wiley-Blackwell, 1981
3. “B. K. Bose”, Modern Power Electronics, and AC Drives, Pearson 2015.
4. “R. Krishnan”, Electric motor drives - modeling, Analysis and control, Prentice Hall PTR, 2001

EE702PC: POWER SYSTEM OPERATION AND CONTROL

B.Tech. IV Year I Sem.

L	T	P	C
4	1	0	4

Prerequisite: Power Systems - I & Power Systems - II

Course Objectives:

- To understand real power control and operation
- To know the importance of frequency control
- To analyze different methods to control reactive power
- To understand unit commitment problem and importance of economic load dispatch
- To understand real time control of power systems

Course Outcomes: After completion of this course, the student will be able to

- Analyze the optimal scheduling of power plants
- Analyze the steady state behavior of the power system for voltage and frequency fluctuations
- Describe reactive power control of a power system
- Design suitable controller to dampen the frequency and voltage steady state oscillations

UNIT – I

Load –Frequency Control: Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel. Control area concept LFC control of a single-area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two-area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.

UNIT – II

Reactive Power – Voltage Control: Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power. Relation between voltage, power and reactive power at a node - method of voltage control - tap-changing transformer. System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

UNIT – III

Economic Load Dispatch: Statement of economic dispatch problem – cost of generation – incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and λ-iteration method.

UNIT – IV

Unit Commitment: Statement of Unit Commitment problem – constraints; spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods - Priority-list methods - forward dynamic programming approach. Numerical problems on priority-list method using full-load average production cost and Forward DP method.

UNIT – V

Computer Control of Power Systems: Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – Importance of Load Forecasting and simple techniques of forecasting.

Text Books:

1. D. P. Kothari and I. J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, 30th reprint, 2007.

Reference Books:

1. Chakrabarti & Haldar, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004 Edition.
2. C. L. Wadhwa , 'Power System Analysis', New Age International-6th Edition, 2010, ISBN : 978-81-224-2839-1
3. Robert Miller, James Malinowski, 'Power System Operation', Tata McGraw Hill Publishing Company Ltd, New Delhi, 3rd Edition 2009.
4. P. Kundur, Neal J. Balu, 'Power System Stability & Control', IEEE, 1998.

EE721PE: DIGITAL SIGNAL PROCESSING (PROFESSIONAL ELECTIVE – II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: This course is an essential course that provides design techniques for processing all type of signals in various fields. The main objectives are:

- To provide background and fundamental material for the analysis and processing of digital signals.
- To familiarize the relationships between continuous-time and discrete time signals and systems.
- To study fundamentals of time, frequency and Z-plane analysis and to discuss the inter-relationships of these analytic method.
- To study the designs and structures of digital (IIR and FIR) filters from analysis to synthesis for a given specifications.
- The impetus is to introduce a few real-world signal processing applications.
- To acquaint in FFT algorithms, Multi-rate signal processing techniques and finite word length effects.

Course Outcomes: On completion of this subject, the student should be able to:

- Perform time, frequency, and Z -transform analysis on signals and systems.
- Understand the inter-relationship between DFT and various transforms.
- Understand the significance of various filter structures and effects of round off errors.
- Design a digital filter for a given specification.
- Understand the fast computation of DFT and appreciate the FFT processing.
- Understand the tradeoffs between normal and multi rate DSP techniques and finite length word effects.

UNIT - I

Introduction: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems

Realization of Digital Filters: Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

UNIT - II

Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.
Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT, and FFT with General Radix-N.

UNIT - III
IIR Digital Filters: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

UNIT - IV
FIR Digital Filters: Characteristics of FIR Digital Filters, Frequency Response, Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

UNIT - V
Multirate Digital Signal Processing: Introduction, Down Sampling, Decimation, Upsampling, Interpolation, Sampling Rate Conversion, Conversion of Band Pass Signals, Concept of Resampling, Applications of Multi Rate Signal Processing.
Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round off Noise, Methods to Prevent Overflow, Trade off between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

TEXT BOOKS:
1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009
3. Fundamentals of Digital Signal Processing – Loney Ludeman, John Wiley, 2009

REFERENCES:
1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
3. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis, 2nd Edition, Pearson Education, 2009

EE722PE/EI733PE: DIGITAL CONTROL SYSTEMS (PROFESSIONAL ELECTIVE – II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Control Systems

Course Objectives:

- To understand the fundamentals of digital control systems, z-transforms
- To understand state space representation of the control systems, concepts of controllability and observability
- To study the estimation of stability in different domains
- To understand the design of discrete time control systems, compensators, state feedback controllers, state observers through various transformations

Course Outcomes: After completion of this course, the student will be able to

- Carry map S-plane and Z-plane, do state-space analysis
- Carry stability analysis in S-domain and Z-domains
- Carry stability analysis through bilinear transformation and R-H criteria,
- design of discrete-time control systems, design of lag, lead, lead-lag compensators, design of PID controllers and design of state feedback controllers and observers,
- Apply the above concepts to real-world electrical and electronics problems and applications.

UNIT - I

Introduction To Digital Control Systems And Z-Transforms: Introduction - Merits and Demerits of Digital Control Systems - Practical aspects of the choice of sampling rate and Multirate sampling - Basic discrete time signals - Quantization – Sampling Theorem - Data Conversions and Quantization - Sampling process - Mathematical Modeling - Data Reconstruction and Filtering of sampled signals - Zero - Order Hold (ZOH).
z- Transform and Inverse z-Transform, Relationship between s - plane and z - plane - Difference equation - Solution by recursion and z-Transform - Pulse Transfer Functions of the ZOH and relationship between G(s) and G(z) - Bilinear Transformation.

UNIT- II

Input/output Analysis of Digital Control Systems: Pulse transfer function - z transform analysis of open loop, closed loop systems - Modified z Transform - transfer function - Stability of linear digital control systems - Stability tests – Jury Stability test.

Root loci - Frequency domain analysis - Bode plots - Gain margin and phase margin.

UNIT – III

Design of Controllers For I/O Model Digital Control Systems: Cascade and Feedback Compensation by continuous data controllers - Digital controllers - Design using Bilinear Transformation - Realization of Digital PID controllers, Design of Digital Control Systems based on Root Locus Technique.

UNIT – IV

State Space Analysis and State Feedback Control Design of Digital Control Systems: State Equations of discrete data systems, solution of discrete state equations, State Transition Matrix: Computation methods for State Transition Matrix: z - transform method - Relation between State Equations and Pulse Transfer Functions.
Concepts on Controllability and Observability - Pole placement design by state feedback.

UNIT - V

Digital State Observer and Stability Analysis: Design of the full order and reduced order state observer, Design of Dead beat Controller - some case studies - Stability analysis of discrete time systems based on Lyapunov approach.

TEXT BOOKS:

1. K. Ogata, Discrete Time Control Systems, PHI/Addison - Wesley Longman Pte. Ltd., India, Delhi, 1995.
2. B. C Kuo, Digital Control Systems, 2nd Edition, Oxford University Press, Inc., 1992.

REFERENCE BOOKS:

1. F. Franklin, J.D. Powell, and M.L. Workman, Digital control of Dynamic Systems, Addison - Wesley Longman, Inc., Menlo Park, CA , 1998.
2. M. Gopal, Digital Control and State Variable Methods, Tata McGraw Hill, India, 1997.
3. C. H. Houpis and G.B. Lamont, Digital Control Systems, McGraw Hill, 1985.
4. John S. Baey, Fundamentals of Linear State Space Systems, McGraw Hill, 1st edition 1999
5. Bernard Fried Land, Control System Design, McGraw Hill, 1st edition 1986.
6. Dorsay, Continuous and Discrete Control Systems, McGraw Hill, 2001.

EC702PC/ET721PE/EI741PE: VLSI DESIGN (PROFESSIONAL ELECTIVE – II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to:

1. Give exposure to different steps involved in the fabrication of ICs using MOS transistor, CMOS/BICMOS transistors, and passive components.
2. Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of inverters designed with various loads.
3. Give exposure to the design rules to be followed to draw the layout of any logic circuit.
4. Provide concept to design different types of logic gates using CMOS inverter and analyze their transfer characteristics.
5. Provide design concepts to design building blocks of data path of any system using gates.
6. Understand basic programmable logic devices and testing of CMOS circuits.

Course Outcomes: Upon successfully completing the course, the student should be able to:

1. Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.
2. Choose an appropriate inverter depending on specifications required for a circuit
3. Draw the layout of any logic circuit which helps to understand and estimate parasitic of any logic circuit
4. Design different types of logic gates using CMOS inverter and analyze their transfer characteristics
5. Provide design concepts required to design building blocks of data path using gates.
6. Design simple memories using MOS transistors and can understand design of large memories.
7. Design simple logic circuit using PLA, PAL, FPGA and CPLD.
8. Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system

UNIT – I

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS

Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage, g_m, g_{ds}, Figure of merit ωo; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT - II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT – III

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out, Choice of layers.

UNIT - IV

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT - V

Programmable Logic Devices: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.

CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

TEXT BOOKS:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.

REFERENCE BOOKS:

1. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

EE724PE: PROGRAMMABLE LOGIC CONTROLLERS (PROFESSIONAL ELECTIVE – II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Basic Electrical Course or equivalent.

Course Objectives:

- To provide knowledge levels needed for PLC programming and operating.
- To make the students how devices to which PLC input and output modules are connected
- To train the students to create ladder diagrams from process control descriptions.
- To make the students understand various types of PLC registers
- Apply PLC Timers and Counters for the control of industrial processes
- To make the students understand PLC functions, Data Handling Function

Course Outcomes: After completion of this course, the student

- Understand the purpose, functions, and operations of a PLC
- Identify the basic components of the PLC and how they function
- View a directory of processor files using PLC software
- Ability to gain knowledge on Programmable Logic Controllers
- Will understand different types of Devices to which PLC input and output modules are Connected
- To provide the knowledge about understand various types of PLC registers
- Able to create ladder diagrams from process control descriptions
- Ability to apply PLC timers and counters for the control of industrial processes
- Able to use different types PLC functions, Data Handling Function.

UNIT - I

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT - II

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT - III

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT - IV

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT - V

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

Text Books:

1. "John W Webb and Ronald A Reiss", Programmable Logic Controllers – Principle and Applications, PHI, 5th Edition 2003.
2. "JR Hackworth and F. D Hackworth Jr", Programmable Logic Controllers – Programming Method and Applications by - Pearson, 2004

Reference Books:

1. "W. Bolton", Programmable Logic Controllers, Newnes, 4th Edition 2000.

EE731PE: HVDC TRANSMISSION (PROFESSIONAL ELECTIVE – III)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Systems & Power Electronics

Course Objectives:

- To compare EHV AC and HVDC systems
- To analyze Graetz circuit and also explain 6 and 12 pulse converters
- To control HVDC systems with various methods and to perform power flow analysis in AC/DC systems
- To describe various protection methods for HVDC systems and Harmonics

Course Outcomes: After completion of this course the student is able to

- Compare EHV AC and HVDC system and to describe various types of DC links
- Analyze Graetz circuit for rectifier and inverter mode of operation
- Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems
- Describe various protection methods for HVDC systems and classify Harmonics and design different types of filters

UNIT – I

Basic Concepts: Necessity of HVDC systems, Economics and Terminal equipment of HVDC transmission systems, Types of HVDC Links, Apparatus required for HVDC Systems, Comparison of AC and DC Transmission, Application of DC Transmission System, Planning and Modern trends in D.C. Transmission.

Analysis of HVDC Converters: Choice of Converter Configuration, Analysis of Graetz circuit, Characteristics of 6 Pulse and 12 Pulse converters, Cases of two 3 phase converters in Y/Y mode – their performance.

UNIT – II

Converter and HVDC System Control: Principle of DC Link Control, Converters Control Characteristics, Firing angle control, Current and extinction angle control, Effect of source inductance on the system, Starting and stopping of DC link, Power Control.

Reactive Power Control In HVDC: Introduction, Reactive Power Requirements in steady state, sources of reactive power- Static VAR Compensators, Reactive power control during transients.

UNIT – III

Power Flow Analysis in AC/DC Systems: Modelling of DC Links, DC Network, DC Converter, Controller Equations, Solution of DC load flow, P.U. System for DC quantities, solution of AC-DC Power flow-Simultaneous method-Sequential method.

UNIT - IV

Converter Faults and Protection: Converter faults, protection against over current and over voltage in converter station, surge arresters, smoothing reactors, DC breakers, Audible noise, space charge field, corona effects on DC lines, Radio interference.

UNIT – V

Harmonics: Generation of Harmonics, Characteristics harmonics, calculation of AC Harmonics, Non- Characteristics harmonics, adverse effects of harmonics, Calculation of voltage and Current harmonics, Effect of Pulse number on harmonics

Filters: Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS

1. "K. R. Padiyar", HVDC Power Transmission Systems: Technology and system Interactions, New Age International (P) Limited, and Publishers, 1990.
2. "S K Kamakshaiah, V Kamaraju", HVDC Transmission , TMH Publishers, 2011
3. "S. Rao", EHVAC and HVDC Transmission Engineering and Practice, Khanna publications, 3rd Edition 1999.

Reference Books:

1. "Jos Arrillaga", HVDC Transmission, The institution of electrical engineers, IEE power & energy series 29, 2nd edition 1998.
2. "E. W. Kimbark", Direct Current Transmission, John Wiley and Sons, volume 1, 1971.
3. "E. Uhlmann", Power Transmission by Direct Current, B. S. Publications, 2009

MT723PE/EE732PE: RELIABILITY ENGINEERING (PROFESSIONAL ELECTIVE – III)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics III

Course Objectives:

- To introduce the basic concepts of reliability, various models of reliability
- To analyze reliability of various systems
- To introduce techniques of frequency and duration for reliability evaluation of repairable systems

Course Outcomes: After completion of this course, the student will be able to

- model various systems applying reliability networks
- evaluate the reliability of simple and complex systems
- estimate the limiting state probabilities of repairable systems
- apply various mathematical models for evaluating reliability of irreparable systems

UNIT – I

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.

Definition of Reliability: Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time Between Failures.

UNIT – II

Network Modeling and Evaluation Of Simple Systems: Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems- Series-Parallel systems- Partially redundant systems- Examples.

Network Modeling and Evaluation of Complex systems: Conditional probability method- tie set, Cutset approach- Event tree and reduced event tree methods- Relationships between tie and cutsets- Examples.

UNIT – III

Time Dependent Probability: Basic concepts- Reliability function f(t). F(t), R(t) and h(t) - Relationship between these functions.

Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

UNIT – IV

Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Examples

Continuous Markov Processes: Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems

UNIT – V

Frequency and Duration Techniques: Frequency and duration concepts, application to multi state problems, Frequency balance approach.

Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press, 1983.
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited, 2002.

REFERENCE BOOK:

1. K. K. Agarwal, Reliability Engineering-Kluwer Academic Publishers, 1993**.**

EE733PE/EC741PE: OPTIMIZATION TECHNIQUES (PROFESSIONAL ELECTIVE – III)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics –I & Mathematics –II

Course Objectives:

- To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
- Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project implementation.

Course Outcomes: After completion of this course, the student will be able to

- explain the need of optimization of engineering systems
- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
- apply unconstrained optimization and constrained non-linear programming and dynamic programming
- Formulate optimization problems.

UNIT – I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints.

Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear

simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT – III

Unconstrained Nonlinear Programming: One dimensional minimization methods, Classification, Fibonacci method and Quadratic interpolation method

Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method.

UNIT – IV

Constrained Nonlinear Programming: Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT – V

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOKS:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

REFERENCE BOOKS:

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

EE734PE: UTILIZATION OF ELECTRIC POWER (PROFESSIONAL ELECTIVE – III)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Machines-I & Electrical Machines-II

Course Objectives:

- To understand the fundamentals of illumination and good lighting practices
- To understand the methods of electric heating and welding.
- To understand the concepts of electric drives and their application to electrical traction systems.

Course Outcomes: After completion of this course, the student will be able to

- Acquire knowledge on, electric drives characteristics and their applicability in industry based on the nature of different types of loads and their characteristics
- understands the concepts and methods of electric heating, welding, illumination and electric traction
- apply the above concepts to real-world electrical and electronics problems and applications.

UNIT – I

Electric Drives: Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT – II

Electric Heating: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating.

Electric Welding: Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT – III

Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

Various Illumination Methods: Discharge lamps, MV and SV lamps – comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT – IV

Electric Traction – I: System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking-plugging rheostat braking and regenerative braking.

Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

UNIT – V

Electric Traction-II: Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and coefficient of adhesion.

Text books:

1. E. Openshaw Taylor, Utilisation of Electric Energy – by University press, 1961.
2. Partab, H., 'Art and Science of Utilisation of Electrical Energy', Dhanpat Rai and Sons, New Delhi, 1986.

Reference books:

1. N. V. Suryanarayana, Utilization of Electrical Power including Electric drives and Electric traction, New Age International (P) Limited, Publishers, 1996.
2. C. L. Wadhwa, Generation, Distribution and Utilization of electrical Energy, New Age International (P) Limited, Publishers, 1997.
3. Tripathy, S.C., 'Electric Energy Utilisation and Conservation', Tata McGraw Hill Publishing Company Ltd. New Delhi, 1991.

EE741PE: SWITCH MODE POWER SUPPLIES (PROFESSIONAL ELECTIVE – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Electronics

Course Objectives:

- The introduction of concept of switched mode power supply with both D.C. and A.C. outputs.
- To elaborately study the working of switched mode topologies including resonant power suppliers.
- To have the knowledge of their importance and applications in various fields.

Course Outcomes: After completion of this course the students are able to

- Understand the concepts and principle of operation of various types of switched mode power supply systems for both D.C. and A.C. outputs.

UNIT -I

Switched Mode Power Conversion: Introduction to Switched Mode Power Supply**,** Linear DC to DC Power converters, Non- Idealities in reactive elements, Design of Inductors, Design of Transformers- Copper loss, Power factor, Non-isolated topologies, Isolated topologies, Quasi-resonant zero-current/zero-voltage switch Operating principle of Non-Isolated DC to DC power Converters (Buck, Boost, Buck-Boost, and Cuk) Equivalent circuit model of the non-isolated DC-DC converters. Isolated converters (forward, Flyback).

UNIT - II

Multiple Output Flyback Switch Mode Power Supplies: Introduction, operating Modes, operating principles, Direct off line Flyback Switch Mode Power Supplies, Flyback converter, snubber network, Problems.

UNIT – III

Using Power Semiconductors in Switched Mode Topologies: Introduction to Switched Mode Power Supply Topologies, The Power Supply Designer's Guide to High Voltage Transistors, Base Circuit Design for High Voltage Bipolar Transistors in Power Converters, Isolated Power Semiconductors for High Frequency Power Supply Applications

UNIT - IV

Rectification: Explanation, Advantages and disadvantages, SMPS and linear power supply comparison, Theory of operation , Input rectifier stage, Inverter stage, Voltage converter

and output rectifier, Regulation, An Introduction to Synchronous Rectifier Circuits using Power MOS Transistors

UNIT – V

Switch mode variable power supplies: Introduction, variable SMPS techniques, operating principles, practical limiting factors, Efficiency and EMI Applications.

Resonant Power Supplies: An Introduction to Resonant Power Supplies, Resonant Power Supply Converters - The Solution for Mains Pollution Problems.

Text books:

1. "Keith H. Billings and Taylor Morey", "Switch Mode Power Supplies", Tata McGraw-Hill Publishing Company, 3rd edition 2010.
2. "Robert W. Erickson", "Switch Mode Power Supplies", Springer, 2nd edition 2001.

Reference Books:

1. "Sanjaya Maniktala", "Switching Power Supplies A-Z", Elsevier, 2nd Edition 2012
2. "Steven M. Sandler", Switch Mode Power Supplies, Tata McGraw Hill, 1st Edition 2006

EE742PE: ARTIFICIAL NEURAL NETWORKS AND FUZZY SYSTEMS (PROFESSIONAL ELECTIVE – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce the basics of Neural Networks and its architectures.
- To introduce the Fuzzy sets and Fuzzy Logic system components
- To deal with the applications of Neural Networks and Fuzzy systems

Course Outcomes: After completion of this course, the students are able

- To understand artificial neural network models and their training algorithms
- To understand the concept of fuzzy logic system components, fuzzification and defuzzification
- Apply the above concepts to real-world problems and applications.

UNIT – I

Introduction To Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT – II

FeedForward Neural Networks: Single Layer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Multilayer Feed forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT - III

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules,

Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory).
Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem.
Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT – IV

Classical and Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT – V

Fuzzy Logic System: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Text Books:

1. Rajasekharan and Pai, Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications– PHI Publication, 1st Edition, 1905
2. Satish Kumar, Neural Networks, TMH, 2004.

Reference Books:

1. “James A Freeman and Davis Skapura”, Neural Networks, Pearson Education, 2002.
2. “Simon Hakins”, Neural Networks, Pearson Education, 3rd Edition 2008.
3. C. Eliasmith and Ch. Anderson, Neural Engineering, PHI, 2004.

EE743PE: ELECTRICAL DISTRIBUTION SYSTEMS (PROFESSIONAL ELECTIVE – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Power Systems – I & Power Systems - II

Course Objectives:

- To distinguish between transmission and distribution systems
- To understand design considerations of feeders
- To compute voltage drop and power loss in feeders
- To understand protection of distribution systems
- To examine the power factor improvement and voltage control

Course Outcomes: After completion of this course, the student able to

- distinguish between transmission, and distribution line and design the feeders
- compute power loss and voltage drop of the feeders
- design protection of distribution systems
- understand the importance of voltage control and power factor improvement

UNIT – I

General Concepts: Introduction to distribution system, Distribution system planning, Factors effecting the Distribution system planning, Load modeling and characteristics. Coincidence factor - contribution factor - Loss factor - Relationship between the load factor and loss factor. Load growth, Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

Distribution Feeders: Design Considerations of Distribution Feeders: Radial, loop and network types of primary feeders, Introduction to low voltage distribution systems (LVDS) and High voltage distribution systems (HVDS), voltage levels, Factors effecting the feeder voltage level, feeder loading, Application of general circuit constants (A,B,C,D) to radial feeders, basic design practice of the secondary distribution system, secondary banking, secondary network types, secondary mains.

UNIT – II

Substations: Location of Substations: Rating of distribution substation, service area with ‘n’ primary feeders. Benefits derived through optimal location of substations. Optimal location of Substations (Perpendicular bisector rule and X, Y co-ordinate method).

System Analysis: Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines, analysis of non-three phase systems, method to analyze the distribution feeder cost.

UNIT – III

Protection: Objectives of distribution system protection, types of common faults and procedure for fault calculations, over current Protective Devices: Principle of operation of Fuses, Auto-Circuit Recloser - and Auto-line sectionalizes, and circuit breakers.

COORDINATION: Coordination of Protective Devices: Objectives of protection co-ordination, general coordination procedure, Types of protection coordination: Fuse to Fuse, Auto-Recloser to Fuse, Circuit breaker to Fuse, Circuit breaker to Auto-Recloser.

UNIT – IV

Compensation For Power Factor Improvement: Capacitive compensation for power-factor control - Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), effect of series capacitors, difference between shunt and series capacitors, Calculation of Power factor correction, capacitor allocation - Economic justification of capacitors - Procedure to determine the best capacitor location.

UNIT – V

Voltage Control: Voltage Control: Importance of voltage control, methods of voltage control, Equipment for voltage control, effect of shunt capacitors, effect of series capacitors, effect of AVB/AVR on voltage control, line drop compensation, voltage fluctuations.

Text books:

1. Turan Gonen, Electric Power Distribution system Engineering, CRC Press, 3rd Edition 2014.
2. V. Kamaraju, Electrical Power Distribution Systems, Tata Mc Graw Hill Publishing Company, 2nd edition, 2010.

Reference Books:

1. G. Ram Murthy, Electrical Power Distribution hand book, 2nd edition, University press 2004.
2. A.S. Pabla, Electric Power Distribution, Tata McGraw Hill Publishing company, 6th edition, 2013.

EE744PE: HIGH VOLTAGE ENGINEERING (PROFESSIONAL ELECTIVE – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Systems – I, Electromagnetic Field theory

Course Objectives:

- To deal with the detailed analysis of Breakdown occurring in gaseous, liquids and solid dielectrics
- To inform about generation and measurement of High voltage and current
- To introduce High voltage testing methods

Course Outcomes: After completion of this course, the student will be able to

- Acquire knowledge on, basics of high voltage engineering
- understand break-down phenomenon in different types of dielectrics
- understand generation and measurement of high voltages and currents
- understand the phenomenon of over-voltages, concept of insulation co-ordination
- know testing of various materials and electrical apparatus used in high voltage engineering

UNIT – I

Introduction To High Voltage Technology And Applications: Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

UNIT – II

Break Down In Gaseous And Liquid Dielectrics: Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law - Liquid as insulator, pure and commercial liquids - breakdown in pure and commercial liquids.

Break Down In Solid Dielectrics: Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

UNIT – III

Generation of High Voltages And Currents: Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators.

Measurement Of High Voltages And Currents: Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

UNIT – IV

Non-Destructive Testing Of Material And Electrical Apparatus: Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements.

High Voltage Testing Of Electrical Apparatus: Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, and Radio Interference measurements.

UNIT – V

Over Voltage Phenomenon And Insulation Co-Ordination: Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Text Books:

1. M. S. Naidu and V. Kamaraju , High Voltage Engineering by– TMH Publications, 4th Edition 2009.
2. E. Kuffel, W. S. Zaengl, J. Kuffel , High Voltage Engineering: Fundamentals by Elsevier, 2nd Edition 2000.

Reference Books:

1. C. L. Wadhwa, High Voltage Engineering by, New Age Internationals (P) Limited, 1997.
2. Ravindra Arora, Wolfgang Mosch, High Voltage Insulation Engineering by, New Age International (P) Limited, 1995.
3. “Mazen Abdel Salam, Hussein Anis, Ahdan El-Morshedy and Roshdy Radwan”, High Voltage Engineering, Theory and Practice, CRC Press, 2nd Edition 2000.

EE703PC: ELECTRICAL SYSTEMS SIMULATION LAB

B.Tech. IV Year I Sem.

L	T	P	C
0	0	3	2

Prerequisite: Electrical and Electronic circuits, Power System Analysis & Power Electronics

Course Objectives:

- To Simulate and analyse electrical and electronic systems**.**
- To evaluate the performance of transmission lines.
- To Analyze various Faults in power systems
- To Model, simulate and analyze the performance of DC Machines and Induction Motors.
- To Analyze performance of feedback and load frequency control of the systems

Outcomes: After going through this lab the student will be able to

- Design and Analyze electrical systems in time and frequency domain
- Analyze various transmission lines and perform fault analysis
- Model Load frequency control of Power Systems
- Design various Power Electronic Converters and Drives.

Any ten of the following experiments are required to be conducted using suitable software

1. Design of first and second order circuits in time and frequency domain
2. Performance evaluation of medium and long transmission lines
3. Symmetrical component analysis
4. Transmission Line Fault Analysis
5. LG, LL and 3-Φ fault analysis of Transformer
6. Short Circuit Analysis of Power system models
7. Speed Control of DC Motor
8. Speed Control of Induction motor
9. Design and analysis of feedback control system
10. Transient analysis of open ended line and short circuited line
11. Load frequency control of single area and two area power system

12. Economic Dispatch of Thermal Units
13. Design of Single Phase and Three Phase Inverters
14. Design of Single Phase and Three Phase Full Converters

Reference Books:

1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub. Co., 2001.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.
3. "I. J. Nagrath & M. Gopal", Control Systems Engineering, New Age International Pub. Co., 5th Edition 2009.
4. A.E. Clayton & C.I. Hancock Performance and Design of DC Machines, CBS Publisher, 1st Edition 2004.

EE704PC: ELECTRICAL WORKSHOP

B.Tech. IV Year I Sem.

L	T	P	C
0	0	3	2

Prerequisite: Basics of Electrical Engineering

Course Objectives:

- To enhance practical knowledge related to different subjects
- To develop hardware skills such as soldering, winding etc.
- To develop debugging skills.
- To increase ability for analysis and testing of circuits.
- To give an exposure to market survey for available components
- To develop an ability for proper documentation of experimentation.
- To enhance employability of a student.
- To prepare students for working on different hardware projects**.**

Course Outcomes: After completion of course, student will be able to

- Get practical knowledge related to electrical
- Fabricate basic electrical circuit elements/networks
- Trouble shoot the electrical circuits
- Design filter circuit for application
- Get hardware skills such as soldering, winding etc.
- Get debugging skills.

Group A:

1. Design and fabrication of reactor/ electromagnet for different inductance values.
2. Design and fabrication of single phase Induction/three phase motor stator.
3. Start delta starter wiring for automatic and manual operation.
4. Wiring of distribution box with MCB, ELCB, RCCB and MCCB.
5. Wiring of 40 W tube, T-5, LED, Metal Halide lamps and available latest luminaries.
6. Assembly of various types of contactors with wiring.
7. Assembly of DOL and 3 point starter with NVC connections and overload operation.

Group B: This group consists of electronic circuits which must be assembled and tested on general purpose PCB or bread boards.

1. Design and development of 5 V regulated power supply.
2. Design and development of precision rectifier.
3. Design and development of first order/ second order low pass/high pass filters with an application.
4. Microcontroller Interface circuit for temperature/level/speed/current/voltage measurement.
5. Peak detector using op-amplifiers.
6. Zero crossing detector using op-amplifiers.

EE851PE: SMART ELECTRIC GRID
(PROFESSIONAL ELECTIVE – V)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Systems - II & Electrical Distribution Systems

Course Objectives:

- To group various aspects of the smart grid
- To defend smart grid design to meet the needs of a utility
- To select issues and challenges that remain to be solved
- To analyze basics of electricity, electricity generation, economics of supply and demand, and the various aspects of electricity market operations in both regulated and deregulated environment.

Course Outcomes: Upon the completion of the subject, the student will be able to

- Recite the structure of an electricity market in either regulated or deregulated market conditions.
- Understand the advantages of DC distribution and developing technologies in distribution
- Discriminate the trade-off between economics and reliability of an electric power system, differentiate various investment options (e.g. generation capacities, transmission, renewable, demand-side resources, etc) in electricity markets
- Analyze the development of smart and intelligent domestic systems.

UNIT – I

Introduction: Introduction to smart grid- Electricity network-Local energy networks-Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.

Smart Grid to Evolve a Perfect Power System: Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

UNIT – II

DC Distribution and Smart Grid: AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighbourhood-Potential future work and research.

Intelligrid Architecture for the Smart grid: Introduction- Launching intelligrid- Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies. SCADA, synchro phasors (WAMS)

UNIT – III

Dynamic Energy Systems Concept: Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems- Integrated communications architecture-Energy management-Role of technology in demand response-Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

UNIT – IV

Energy Port As Part Of The Smart Grid: Concept of energy -Port, generic features of the energy port. **Policies and Programs to Encourage End – Use Energy Efficiency:** Policies and programs in action -multinational - national-state-city and corporate levels.
Market Implementation: Framework-factors influencing customer acceptance and response - program planning-monitoring and evaluation.

UNIT – V

Efficient Electric End – Use Technology Alternatives: Existing technologies – lighting - Space conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances - Ductless residential heat pumps and air conditioners - Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency- LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement - Process heating - Cogeneration, Thermal energy storage - Industrial energy management programs - Manufacturing process-Electro-technologies, Residential, Commercial and industrial sectors.

Text Books:

1. Clark W Gellings, “The Smart Grid, Enabling Energy Efficiency and Demand Side Response”- CRC Press, 2009.
2. Jean Claude Sabonnadiere, Nouredine Hadjsaid, “Smart Grids”, Wiley-ISTE, IEEE Press, May 2012

Reference Books:

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong. Wu, Akihiko Yokoyama, Nick Jenkins, “Smart Grid: Technology and Applications”- Wiley, 2012.
2. James Momoh, “Smart Grid: Fundamentals of Design and Analysis”-Wiley, IEEE Press, 2012.

EE852PE: SOLAR PHOTO VOLTAIC SYSTEMS (PROFESSIONAL ELECTIVE – V)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Engineering Physics - II

Course Objectives:

- To introduce photovoltaic systems
- To deal with various technologies of solar PV cells
- To understand details about manufacture, sizing and operating techniques
- To have knowledge of design considerations.

Course Outcomes: After this course, the student will be able to

- Identify photovoltaic system components and system types
- Calculate electrical energy and power
- Correctly size system components, design considerations of solar equipment
- Design a basic grid-tie PV system.

UNIT – I

Solar Energy: Sun and Earth, Solar Spectrum, Solar Geometry, Solar radiation on horizontal and inclined planes, Instruments for measurement of solar radiation ,Solar cell, Equivalent circuit, V-I characteristics, Performance improvement.

UNIT - II

Solar Cells: Manufacture of Solar Cells-Technologies, Design of Solar cells, Photovoltaic modules, Design requirements, encapsulation systems, manufacture, power rating, hotspot effect, Design qualifications.

UNIT - III

Protection and Measurements: Flat plate arrays, support structures, module interconnection and cabling, lightning protection, Performance measurement – using natural sun light and simulator, determination of temperature coefficients, internal series resistance, curve correction factor.

UNIT – IV

Photovoltaic Systems: Photovoltaic systems- types- general design considerations- system sizing-battery sizing- inverter sizing-design examples – Balance of PV systems.

UNIT – V

Maximum Power Point Trackers: Maximum power point trackers-algorithms- perturb and observe-incremental conductance method, hill climbing method, , hybrid and complex methods, data based and other approximate methods, instrument design, other MPP techniques-Grid interactive PV system.

Text Books:

1. "F. C. Treble", Generating electricity from the sun, Pergamon Press, 1991.
2. "A. K. Mukherjee, Nivedita Thakur", Photvolatic systems: Analysis and design, PHI 2011
3. "C. S. Solanki", Solar Photovoltaics: Fundamentals, Technologies and applications, PHI, 2009

Reference Books:

1. "R.D. Begamudre", Energy Conversion Systems, New Age International 2000.

EE853PE: MODERN POWER ELECTRONICS (PROFESSIONAL ELECTIVE – V)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Electronics

Course Objectives:

- To understand various Power Electronics devices such as SCR, TRIAC, DIAC, IGBT, GTO etc.
- To understand application of aforesaid Power Electronics devices in Choppers, Inverters and Converters etc.
- To understand control of Electrical Motors through DC-DC converters, AC Converters etc.
- To understand the use of Inductors and Capacitors in Choppers, Inverters and Converters.

Course outcomes: Students are able to

- To understand various Power Electronics devices such as SCR, TRIAC, DIAC, IGBT, GTO etc.
- To understand application of aforesaid Power Electronics devices in Choppers, Inverters and Converters etc.
- To understand control of Electrical Motors through DC-DC converters, AC Converters etc.
- To understand the use of Inductors and Capacitors in Choppers, Inverters and Converters.

UNIT - I

High-Power Semiconductor Devices: Introduction, High-Power Switching Devices, Diodes, Silicon-Controlled Rectifier (SCR), Gate Turn-Off (GTO) Thyristor, Gate-Commutated Thyristor (GCT), Insulated Gate Bipolar Transistor (IGBT), Other Switching Devices, Operation of Series-Connected Devices, Main Causes of Voltage Unbalance ,Voltage Equalization for GCTs,

UNIT-II

Cascaded H-Bridge Multilevel Inverters: Introduction, Sinusoidal PWM ,Modulation Scheme, Harmonic Content, Over modulation, Third Harmonic Injection PWM, Space Vector Modulation , Switching States , Space Vectors, Dwell Time Calculation, Modulation

Index, Switching Sequence, Spectrum Analysis, Even-Order Harmonic Elimination, Discontinuous Space Vector Modulation.
Introduction, H-Bridge Inverter, Bipolar Pulse-Width Modulation, Unipolar Pulse-Width Modulation.

UNIT - III

Diode-Clamped Multilevel Inverters: Three-Level Inverter, Converter Configuration, Switching State ,Commutation, Space Vector Modulation, Stationary Space Vectors , Dwell Time Calculation, Relationship Between V_refLocation and Dwell Times, Switching Sequence Design, Inverter Output Waveforms and Harmonic Content , Even-Order Harmonic Elimination, Neutral-Point Voltage Control, Causes of Neutral-Point Voltage Deviation , Effect of Motoring and Regenerative Operation, Feedback Control of Neutral-Point Voltage

UNIT - IV

DC-DC Switch-Mode Converters & Switching DC Power Supplies Control of dc-dc converter, Buck converter, boost converter, buck-boost converter, cuk dc-dc converter, full-bridge dc-dc converter, dc-dc converter comparison. Introduction, linear power supplies, overview of switching power supplies, dc-dc converters with electrical isolation, control of switch mode dc power supplies, power supply protection, and electrical isolation in the feedback loop, designing to meet the power supply specifications.

UNIT - V

Resonant Converters & Power Conditioners And Uninterruptible Power Supplies Classification of resonant converters, basic resonant circuit concepts, load-resonant converters, resonant-switch converters, zero-voltage-switching, resonant-dc-link inverters with zero-voltage switching's, high frequency-link integral-half cycle converters. Power line disturbances, Introduction to Power Quality, power Conditioners, uninterruptible power supplies, Applications.

Text Books:

1. "M. H. Rashid", Power electronics circuits, Devices and applications, PHI, I edition – 1995.
2. "Ned Mohan, Tore M. Undeland and William P. Robbins, A", "Power Electronics converters, Applications and Design" John Wiley & Sons, Inc., Publication, 3rd Edition 2003

Reference Books:

1. "Bin Wu, A", "High-Power Converters and Ac Drives" John Wiley & Sons, Inc., Publication (Free down load from rapidshire.com) 2006.

EE854PE: SPECIAL MACHINES
(PROFESSIONAL ELECTIVE – V)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Machines - I & Electrical Machines - II

Course objectives:

- To understand the working and construction of special machines
- To know the use of special machines in different feed-back systems
- To understand the use of micro-processors for controlling different machines

Course Outcomes: Upon the completion of this subject, the student will be able

- To select different special machines as part of control system components
- To use special machines as transducers for converting physical signals into electrical signals
- To use micro-processors for controlling different machines
- To understand the operation of different special machines

UNIT – I

Special Types of DC Machines - I: Series booster-Shunt booster-Non-reversible boost-Reversible booster

Special Types of DC Machines – II: Armature excited machines—Rosenberg generator-The Amplidyne and metadyne— Rototrol and Regulex-third brush generator-three-wire generator-dynamometer.

UNIT – II

Stepper Motors: Introduction-synchronous inductor (or hybrid stepper motor), Hybrid stepping motor, construction, principles of operation, Energisation with two phase at a time-essential conditions for the satisfactory operation of a 2-phase hybrid step motor- very slow-speed synchronous motor for servo control-different configurations for switching the phase windings-control circuits for stepping motors-an open-loop controller for a 2-phase stepping motor.

UNIT – III

Variable Reluctance Stepping Motors: Variable reluctance (VR) Stepper motors, single-stack VR step motors, Multiple stack VR motors-Open-loop control of 3-phase VR step motor-closed-Loop control of step motor, discriminator (or rotor position sensor) transilator, major loop-characteristics of step motor in open-loop drive – comparison between open-loop

position control with step motor and a position control servo using a conventional (dc or ac) servo motor- Suitability and areas of application of stepper motors-5- phase hybrid stepping motor-single phase-stepper motor, the construction, operating principle torque developed in the motor.

Switched Reluctance Motor: Introduction – improvements in the design of conventional reluctance motors- Some distinctive differences between SR and conventional reluctance motors-principle of operation of SRM- Some design aspects of stator and rotor pole arcs, design of stator and rotor and pole arcs in SR motor-determination of L(θ)--- θ profile – power converter for SR motor-A numerical example –Rotor sensing mechanism and logic control, drive and power circuits, position sensing of rotor with Hall problems—derivation of torque expression, general linear case.

UNIT – IV

Permanent Magnet Materials And Motors: Introduction, Hysteresis loops and recoil line-stator frames (pole and yoke - part)of conventional PM dc Motors, Equivalent circuit of a PM-Development of Electronically commutated dc motor from conventional dc motor.

Brushless DC Motor: Types of construction – principle of operation of BLDM- sensing and switching logic scheme, sensing logic controller, lockout pulses –drive and power circuits, Base drive circuits, power converter circuit-Theoretical analysis and performance prediction, modeling and magnet circuit d-q analysis of BLDM -transient analysis formulation in terms of flux linkages as state variables-Approximate solution for current and torque under steady state –Theory of BLDM as variable speed synchronous motor (assuming sinusoidal flux distribution)- Methods or reducing Torque Pulsations, 180 degrees pole arc and 120 degree current sheet.

UNIT – V

Linear Induction Motor: Development of a double sided LIM from rotary type IM- A schematic of LIM drive for electric traction development of one sided LIM with back iron-field analysis of a DSLIM fundamental assumptions.

Text Books:

1. K. Venkataratnam, Special electrical machines, university press, 2009.
2. R. K. Rajput - Electrical machines, Laxmi Publications, 5th Edition 2016.
3. V.V. Athani - Stepper motor: Fundamentals, Applications and Design, New age International publishers, 1997.

Reference Book:

1. “E. G. Janardanan”, Special electrical machines-PHI 2014.

EE861PE: FLEXIBLE A.C. TRANSMISSION SYSTEMS (PROFESSIONAL ELECTIVE – VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Electronics, Power System Analysis & Power System Operation and Control

Course Objectives:

- To understand the fundamentals of FACTS Controllers,
- To know the importance of controllable parameters and types of FACTS controllers & their benefits
- To understand the objectives of Shunt and Series compensation
- To Control STATCOM and SVC and their comparison and the regulation of STATCOM, Functioning and control of GCSC, TSSC and TCSC

Course Outcomes: After completion of this course the student is able to

- Choose proper controller for the specific application based on system requirements
- Understand various systems thoroughly and their requirements
- Understand the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping
- Understand the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

UNIT - I

Facts Concepts: Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, and benefits from FACTS controllers.

UNIT - II

Voltage Source Converters: Single phase, three phase full wave bridge converters transformer connections for 12 pulse operation.

Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters.

UNIT - III

Static Shunt Compensation: Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable var generation, variable impedance type static var generators, switching converter type var generators and hybrid var generators.

UNIT - IV

SVC and STATCOM: SVC: FC-TCR and TSC-TCR. STATCOM: The regulation and slope. Comparison between SVC and STATCOM

UNIT - V

Static Series Compensators: Objectives of Series compensation, concept of series capacitive compensation, GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC) control schemes for GSC TSSC and TCSC.

Text Books:

1. "N.G. Hingorani and L. Guygi", Understanding FACTS Devices, IEEE Press Publications 2000.
2. "Yong- Hua Song, Allan Johns", Flexible AC Transmission System, IEE Press 1999.

Reference Books:

1. "Kalyan K. Sen and Meylingsen", Introduction to FACTS Controllers, John wiley& sons, Inc., Mohamed E.EI – Hawary Series editor, 2009.
2. "K. R Padiyar, Motilal",FACTS controllers in power transmission and distribution UK Books of India 2007.

EE862PE: EMBEDDED SYSTEMS
(PROFESSIONAL ELECTIVE – VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Microprocessor and Microcontrollers Concepts

Course Objectives:

- Learn the general embedded system concepts
- Understand design of embedded hardware and software development tools
- Learn the basics of OS and RTOS
- Describe key issues such as CPU scheduling, memory management, task synchronization, and file system in the context of real-time embedded systems.

Course Outcomes: After Completion of the course the student is able to

- Understand and design real time and non real time embedded systems
- Define the unique design challenges of real-time systems and program them.
- Understand unique characteristics of RTOS and use RTOS to build an embedded real-time system

UNIT - I

Fundamentals Of Embedded Systems: Definition – Classification of Embedded Systems - Processors in the system - Other Hardware units. Software components - Examples for embedded systems, Design issues and trends

UNIT - II

Embedded Hardware Development Environment: Processor Architecture- Structured units of a processor - Processor selection factors. Common memory devices - Memory selection - Memory map - Internal devices & I/O devices, Serial devices - Parallel port devices, Timer and Counting devices - Direct memory access, Communication Interface Standards,.

UNIT - III

Embedded Software Development Environment: Embedded System Development Process, Embedded Operating systems, Types of Embedded Operating systems, Host and Target machines, Linkers/Locators for embedded software, getting embedded software into the target system, testing on host machine.

UNIT - IV

Real Time Operating Systems Concepts – I: Typical OS structure - RTOS structure - The context of its use - Schedule management for multiple tasks - Scheduling in real time - RTOS task scheduling models – Round Robin, Round Robin with Interrupts, Priority driven-Preemptive and Non-preemptive scheduling

UNIT - V

Real Time Operating Systems Concepts - II: Tasks and Task states, Tasks and Data, Semaphores and shared data, Message queues, Mailboxes and Pipes, Timer functions, events, Memory management, Interrupt routines in an RTOS environment.

Case study of RTOS using MUCOS. Case study for RTOS based programming - Coding for Automatic Chocolate vending machine using MUCOS.

Text Books:

1. "David E. Simon", an Embedded Software Primer, Pearson Ed., 2005.
2. "Raj Kamal", Embedded systems - architecture, programming and design, Tata McGraw Hill, 2011

Reference Books:

1. "J. W. S. Liu", Real time Systems, Pearson, 2000.
2. "Ayala & Gadre", The 8051 Microcontroller & Embedded Systems using Assembly and C, Cengage Publications, 2010.

EE863PE: POWER QUALITY
(PROFESSIONAL ELECTIVE – VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Systems - II

Course Objectives:

- Definition of power quality and different terms of power quality.
- Study of voltage power quality issue – short and long interruption.
- Detail study of characterization of voltage sag magnitude and three phase unbalanced voltage sag.
- Know the behaviour of power electronics loads; induction motors, synchronous motor etc by the power quality issues.
- Overview of mitigation of power quality issues by the VSI converters.

Course Outcomes: After completion of this course, the student will be able to:

- Know the severity of power quality problems in distribution system
- Understand the concept of voltage sag transformation from up-stream (higher voltages) to down-stream (lower voltage)
- Concept of improving the power quality to sensitive load by various mitigating custom power devices

UNIT – I

Introduction: Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT – II

Long & Short Interruptions: Interruptions – Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption – Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.

Short interruptions: definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events,

single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT – III

Single and Three Phase Voltage Sag Characterization: Voltage sag – definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration.

Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT – IV

Power Quality Considerations In Industrial Power Systems: Voltage sag – equipment behaviour of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT - V

Mitigation of Interruptions & Voltage Sags: Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Power Quality and EMC Standards: Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

Text Books:

1. “Math H J Bollen”, “Understanding Power Quality Problems” , IEEE Press, 2000.
2. “R. Sastry Vedam and Mulukutla S. Sarma”, “Power Quality VAR Compensation in Power Systems”, CRC Press, 2008.

Reference Books:

1. C. Sankaran, Power Quality, CRC Press 2001.
2. Roger C. Dugan , Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, Tata McGraw Hill Education Private Ltd, 3rd Edition 2012.

EE864PE: EHV AC TRANSMISSION SYSTEMS
(PROFESSIONAL ELECTIVE –VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power systems - II

Course Objectives:

- To understand the basic concepts of EHV AC transmission.
- To get the Knowledge on EHV transmission line inductance and capacitance
- To understand the voltage gradients of conductor
- To identify corona effects on transmission lines
- To calculate electrostatic fields of EHV AC lines and its effects
- To Analyze travelling waves
- To distinguish various compensators for voltage control

Course Outcomes: After completion of this course, the student will be able to:

- Understand the basic concepts of EHV AC transmission.
- Get the Knowledge on EHV transmission line inductance and capacitance
- Understand the voltage gradients of conductor
- Identify corona effects on transmission lines
- Calculate electrostatic fields of EHVAC lines and its effects
- Analyze travelling waves
- Distinguish various compensators for voltage control

UNIT – I

Preliminaries: Necessity of EHV AC transmission – advantages and problems–power handling capacity and line losses- mechanical considerations – resistance of conductors – properties of bundled conductors – bundle spacing and bundle radius- Examples.

UNIT – II

Line and Ground Reactive Parameters: Line inductance and capacitances – sequence inductances and capacitances – modes of propagation – ground return - Examples

Voltage Gradients of Conductors: Electrostatics – field of sphere gap – field of line changes and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on sub-conductors of bundle – Examples.

UNIT – III

Corona Effects – I: Power loss and audible noise (AN) – corona loss formulae – charge voltage diagram – generation, characteristics - limits and measurements of AN – relation between 1-phase and 3-phase AN levels – Examples.

Corona Effects – II: Radio interference (RI) - corona pulses generation, properties, limits – frequency spectrum – modes of propagation – excitation function – measurement of RI, RIV and excitation functions – Examples.

UNIT – IV

Electro Static Field: Electrostatic field: calculation of electrostatic field of EHV/AC lines – effect on humans, animals and plants – electrostatic induction in unenergised circuit of double-circuit line – electromagnetic interference-Examples.

Traveling Wave Theory: Traveling wave expression and solution- source of excitation-terminal conditions- open circuited and short-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines-generalized constants-No load voltage conditions and charging current.

UNIT – V

Line Compensation: Power circle diagram and its use – voltage control using synchronous condensers – cascade connection of shunt and series compensation – sub synchronous resonance in series capacitor – compensated lines – static VAR compensating system.

Text Books:

1. "R. D. Begamudre", EHVAC Transmission Engineering, New Age International (p) Ltd., 3rd Edition 2006.
2. S. Rao, HVAC and DC Transmission, Khanna Publishers, 3rd Edition 2001.

Reference Books:

1. "E. Kuffel, W. S. Zaengl, J. Kuffel", High Voltage Engineering Fundamentals, Elsevier, 3rd Edition 2016.
2. "Mazen Abdel-salam, Hussein Ains, Abdab EI – Mors hedy and Roshdy Radwan", High Voltage Engineering: Theory and Practice, CRC Press, 2nd Edition 2000.
3. "Hugh M. Ryan", High Voltage Engineering and Testing, IEE power and energy series 32, The Institution of Engineering and Technology 2nd edition 2001.

B.TECH. AERONAUTICAL ENGINEERING
INTRODUCTION TO SPACE TECHNOLOGY
(OPEN ELECTIVE - I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: AE511OE	**3**	**0**	**0**	**3**

UNIT - I

Fundamentals of Rocket Propulsion and Trajectories: Space Mission- Types-Space environment-launch vehicle selection.; Introduction to rocket propulsion-fundamentals of solid propellant rockets- Fundamentals of liquid propellant rockets-Rocket equation, Two-dimensional trajectories of rockets and missiles-Multi-stage rockets-Vehicle sizing-Two multi-stage rockets-Trade-off ratios-Single stage to orbit- Sounding rocket-Aerospace plane-Gravity turn trajectories-Impact point calculation-Injection conditions-Flight dispersions

UNIT- II

Atmospheric Re-entry: Introduction-Steep ballistic re-entry-Ballistic orbital re-entry-Skip re-entry-"Double- Dip" re-entry - Aero-braking - Lifting body re-entry

UNIT-III

Fundamentals of Orbital Mechanics, Orbital Manoeuvres: Two-body motion-circular, elliptic, hyperbolic, and parabolic orbits-Basic orbital elements-Ground trace**.** In-Plane orbit changes-Hohmann transfer-Bi-elliptical transfer-Plane changes- Combined manoeuvres-Propulsion for manoeuvres

UNIT - IV

Satellite Attitude Dynamics: Torque free axisymmetric rigid body-Attitude control for spinning spacecraft - Attitude control for non-spinning spacecraft - The Yo-Yo mechanism – Gravity – Gradient satellite-Dual spin spacecraft-Attitude determination

UNIT-V

Space mission Operations: Supporting ground system architecture and team interfaces - Mission phases and core operations- Team responsibilities – Mission diversity – Standard operations practices

TEXT BOOK:

1. 'Spaceflight Dynamics', W.E. Wiesel, 3rd edition, McGraw-Hill, 2010

REFERENCES

1. 'Rocket Propulsion and Space flight dynamics', Cornelisse JW, Schoyer HFR, and Wakker KF, Pitman, 1984
2. 'Fundamentals of Space Systems', Vincet L. Pisacane, Oxford University Press, 2005.

3. ‘Understanding Space: An Introduction to Astronautics’, J. Sellers, 2nd edition, McGraw- Hill, 2004
4. ‘Introduction to Space Flight’, Francis J Hale, Prentice-Hall, 1994
5. ‘Spacecraft Mission Design’, Charles D. Brown, AIAA Education Series, 1998
6. ‘Elements of Space Technology for Aerospace Engineers’, Meyer Rudolph X, Academic Press, 1999

B.TECH. AERONAUTICAL ENGINEERING
INTRODUCTION TO AEROSPACE ENGINEERING
(OPEN ELECTIVE - II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: AE621OE	**3**	**0**	**0**	**3**

UNIT – I

History of Flight and Space Environment: Balloons and dirigibles, heavier than air aircraft, commercial air transport; Introduction of jet aircraft, helicopters, missiles; Conquest of space, commercial use of space; Different types of flight vehicles, classifications exploring solar system and beyond, a permanent presence of humans in space; Earth's atmosphere, the standard atmosphere; The temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity; Environmental impact on spacecraft, space debris; Planetary environments.

UNIT – II

Introduction to Aerodynamics: Anatomy of the airplane, helicopter; Understanding engineering models; Aerodynamic forces on a wing, force coefficients; Generating lift, moment coefficients; Aerodynamic forces on aircraft – classification of NACA airfoils, aspect ratio, wing loading, Mach number, centre of pressure and aerodynamic centre-aerofoil characteristics-lift, drag curves; Different types of drag.

UNIT – III

Flight Vehicle Performance and Stability: Performance parameters, performance in steady flight, cruise, climb, range, endurance, accelerated flight symmetric manoeuvres, turns, sideslips, takeoff and landing; Flight vehicle Stability, static stability, dynamic stability; Longitudinal and lateral stability; Handling qualities of the airplanes.

UNIT – IV

Introduction to Airplane Structures and Materials, Power Plants: General types of construction, monocoque, semi-monocoque; Typical wing and fuselage structure; Metallic & non-metallic materials, use of aluminium alloy, titanium, stainless steel and composite materials. Basic ideas about engines, use of propeller and jets for thrust production; Principles of operation of rocket, types of rockets.

UNIT – V

Satellite Systems Engineering Human Space Exploration: Satellite missions, an operational satellite system, elements of satellite, satellite bus subsystems; Satellite structures, mechanisms and materials; Power systems; Communication and telemetry; Propulsion and station keeping; Space missions, mission objectives. Goals of human space flight missions, historical background, The Soviet and US missions; The Mercury, Gemini, Apollo (manned flight to the moon), Skylab, Apollo-Soyuz, Space Shuttle; International

Space Station, extravehicular activity; The space suit; The US and Russian designs; Life support systems, Flight safety; Indian effort in aviation, missile and space technology.

TEXT BOOKS:

1. Anderson J. D, “Introduction to Flight”, McGraw-Hill, 5th Edition, 1989.
2. Newman D, “Interactive Aerospace Engineering and Design”, McGraw-Hill, 1st Edition, 2002.
3. Barnard R.H and Philpot. D.R, “Aircraft Flight”, Pearson, 3rd Edition, 2004.

REFERENCES

1. Kermode, A. C, “Flight without Formulae”, McGraw Hill, 4th Edition, 1997.
2. Swatton P. J, “Flight Planning”, Blackwell Publisher, 6th Edition, 2002.

B.TECH. AERONAUTICAL ENGINEERING
AIR TRANSPORTATION SYSTEMS
(OPEN ELECTIVE - III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: AE831OE	**3**	**0**	**0**	**3**

UNIT- I

Aviation Industry & Its Regulatory Authorities: Introduction, history of aviation-evolution, development, growth, challenges. Aerospace industry, air transportation industry-economic impact- types and causes. Airline Industry- structure and economic characteristics. The breadth of regulation- ICAO, IATA, national authorities (DGCA, FAA). Safety regulations- risk assessment- human factors and safety, security regulations, environmental regulations.

UNIT-II

Airspace: Categories of airspace- separation minima, airspace sectors- capacity, demand and delay. Evolution of air traffic control system- procedural ATC system, procedural ATC with radar assistance, first generation 'automated' ATC system, current generation radar and computer-based ATC systems. Aerodrome air traffic control equipment and operation - ICAO future air-navigation systems (FANS). Air-navigation service providers as businesses. Communication, navigation and surveillance systems (CNSS). Radio communications- VHF, HF, ACARS, SSR, ADS. Navigation- NDB, VOR, DME, area-navigation systems(R-Nav), ILS, MLS, GPS, INS.

UNIT- III

Aircraft: Costs- project cash-flow, aircraft price. Compatibility with the operational infrastructure. Direct and indirect operating costs. Balancing efficiency and effectiveness-payload-range, fuel efficiency, technical contribution to performance, operating speed and altitude, aircraft field length performance. typical operating costs. Effectiveness- wake-vortices, cabin dimensions, flight deck.

UNIT- IV

Airports: Setting up an airport- airport demand, airport siting, runway characteristics- length, declared distances, aerodrome areas, obstacle safeguarding. Runway capacity- evaluating runway capacity- sustainable runway capacity. Runway pavement length, Manoeuvring area-airfield lighting, aprons, Passenger terminals-terminal sizing and configuration. Airport demand, capacity and delay.

UNIT - V

Airlines: Setting up an airline- modern airline objectives. Route selection and development, airline fleet planning, annual utilization and aircraft size, seating arrangements. Indirect operating costs. Aircraft- buy or lease. Revenue generation, computerized reservation

systems, yield management. Integrating service quality into the revenue-generation process. Marketing the seats. Airline scheduling. Evaluating success- financial viability, regulatory compliance, efficient use of resources, effective service.

TEXT BOOK:

1. Hirst, M., *The Air Transport System*, Woodhead Publishing Ltd, Cambridge, England, 2008.

REFERENCES:

1. Wensven, J.G., *Air Transportation: A Management Perspective*, Eighth Edition, shgate, 2015.
2. Belobaba, P., Odoni, A. and Barnhart, C., *Global Airline Industry*, Second Edition, Wiley, 2015.
3. M. Bazargan, M., *Airline Operations and Scheduling*, Second Edition, Ashgate, 2010.
4. Nolan, M.S., *Fundamentals of Air Traffic Control*, 5th edn., Thomson Learning, 2011.
5. Wells, A. and Young, S., *Airport Planning and Management*, 6th edn., McGraw-Hill, 2011.

B.TECH. AERONAUTICAL ENGINEERING
ROCKETS AND MISSILES
(OPEN ELECTIVE - III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: AE832OE	**3**	**0**	**0**	**3**

UNIT- I

Introduction: Space launch vehicles and military missiles- function, types, role, mission, mission profile, thrust profile, propulsion system, payload, staging, control and guidance requirements, performance measures, design, construction, operation- similarities and differences.

UNIT – II

Solid and Liquid Propulsion Systems: Solid propellant rocket motors, principal features, applications. Solid propellants- types, composition, properties, performance. Propellant grain-desirable properties, grain configurations, Liners, insulators and inhibitors-function, requirements, materials. Rocket motor casing-materials. Combustion system of solid rockets, igniters, types, construction. Nozzles-types, Liquid propellants- types, composition, properties, performance. Propellant tanks feed systems- pressurisation, turbo-pumps- valves and feed lines, injectors, starting and ignition. Engine cooling, support structure, control of engine starting and thrust build-up, liquid rocket combustion chamber

UNIT – III

Aerodynamics of Rockets and Missiles: Classification of missiles. Airframe components of rockets and missiles, Forces acting on a missile while passing through atmosphere, method of describing aerodynamic forces and moments, lateral aerodynamic moment, lateral damping moment, longitudinal moment of a rocket, lift and drag forces, drag estimation, body upwash and downwash in missiles. Rocket dispersion, re-entry body design considerations

UNIT - IV

Dynamics and Control of Rockets and Missiles: Tsiolskovsky's rocket equation- range in the absence of gravity, vertical motion in the earth's gravitational field, inclined motion, flight path at constant pitch angle, motion in the atmosphere, the gravity turn- the culmination altitude. Multi-staging. Earth launch trajectories- vertical segment, the gravity turn, constant pitch trajectory, orbital injection; Rocket thrust vector control-methods of thrust vector control for solid and liquid propulsion systems, thrust magnitude control, thrust termination

UNIT - V

Rocket Testing: Ground testing and flight testing- types of tests, test facilities and safeguards, monitoring and control of toxic materials, instrumentation and data management. Ground testing, flight testing, trajectory monitoring, post accident procedures, Description of a typical space vehicle launch procedure.

TEXT BOOKS:

1. Sutton, G.P., and Biblarz, O., *Rocket Propulsion Elements*, 8th edition, Wiley-Interscience, 2010.
2. Cornelisse, J.W., Schoyer H.F.R. and Wakker, K.F., *Rocket Propulsion and Space-flight Dynamics*, Pitman, 1979.
3. Turner, M.J.L., *Rocket and Spacecraft Propulsion*, 3rd edition, Springer, 2009.

REFERENCES

1. Chin, S.S., *Missile Configuration Design*, McGraw Hill, 1961
2. Ball, K.J., Osborne, G.F., *Space Vehicle Dynamics*, Oxford University Press, 1967.

B.TECH. AUTOMOBILE ENGINEERING

DISASTER MANAGEMENT

(Open Elective - I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: CE511OE	**3**	**0**	**0**	**3**

Course Objectives: The subject provides different disasters, tools and methods for disaster management.

Course Outcomes: At the end of the course, the student will be able to:

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts and planning of disaster managements

UNIT - I

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

UNIT - II

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT - IV

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India -

Organizational structure for disaster management in India - Preparation of state and district disaster management plans

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

B.TECH. AUTOMOBILE ENGINEERING
INTELLECTUAL PROPERTY RIGHTS
(Open Elective - I)

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
Course Code: MT512OE	**3**	**0**	**0**	**3**

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 trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III
Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV
Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V
New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.
International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:
1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

B.TECH. AUTOMOBILE ENGINEERING

DATA STRUCTURES

(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: EM614PE/MT621OE	3	0	0	3

Course Objectives:

- To understand the basic concepts such as Abstract Data Types, Linear, and Non Linear Data structures.
- To understand the notations used to analyze the Performance of algorithms.
- To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
- To choose the appropriate data structure for a specified application.
- To understand and analyze various searching and sorting algorithms.
- To write programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables, search trees.

Course Outcomes:

- Learn how to use data structure concepts for realistic problems.
- Ability to identify appropriate data structure for solving computing problems in respective language.
- Ability to solve problems independently and think critically.

UNIT- I

Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Introduction to Linear and Non Linear data structures.

Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists-Operations- Insertion, Deletion.

Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

UNIT- II

Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition and operations ,array and linked Implementations in C, Circular queues-Insertion and deletion operations, Deque (Double ended queue)ADT, array and linked implementations in C.

UNIT- III

Trees – Terminology, Representation of Trees, Binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals, Threaded binary trees, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

Graphs – Introduction, Definition, Terminology, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph traversals- DFS and BFS.

UNIT- IV

Searching- Linear Search, Binary Search, Static Hashing-Introduction, hash tables, hash functions, Overflow Handling.

Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Comparison of Sorting methods.

UNIT- V

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees-Definition and Examples, Insertion into an AVL Tree ,B-Trees, Definition, B-Tree of order m, operations-Insertion and Searching, Introduction to Red-Black and Splay Trees(Elementary treatment-only Definitions and Examples), Comparison of Search Trees.

Pattern matching algorithm- The Knuth-Morris-Pratt algorithm, Tries (examples only).

TEXT BOOKS:

1. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson-Freed, Universities Press.
2. Data structures A Programming Approach with C, D.S.Kushwaha and A.K.Misra, PHI.

REFERENCE BOOKS:

1. Data structures: A Pseudocode Approach with C, 2nd edition, R. F. Gilberg And B.A. Forouzan, Cengage Learning.
2. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.
3. Data Structures using C, A. M. Tanenbaum, Y. Langsam, M.J. Augenstein, Pearson.
4. Data structures and Program Design in C, 2nd edition, R. Kruse, C. L. Tondo and B. Leung, Pearson.
5. Data Structures and Algorithms made easy in JAVA, 2nd Edition, Narsimha Karumanchi, and Career Monk Publications.
6. Data Structures using C, R. Thareja, Oxford University Press.
7. Data Structures, S. Lipscutz, Schaum's Outlines, TMH.
8. Data structures using C, A. K. Sharma, 2nd edition, Pearson..
9. Data Structures using C &C++, R. Shukla, Wiley India.
10. Classic Data Structures, D. Samanta, 2nd edition, PHI.
11. Advanced Data structures, Peter Brass, Cambridge.

B.TECH. AUTOMOBILE ENGINEERING
ARTIFICIAL NEURAL NETWORKS
(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: MT622OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.

Course Outcomes: By completing this course the student will be able to:

- Create different neural networks of various architectures both feed forward and feed backward.
- Perform the training of neural networks using various learning rules.
- Perform the testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.

UNIT - I

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT - II

Single Layer Perceptron: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT - III

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues, and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT - IV

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT - V

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm

Hopfield Models – Hopfield Models, Computer Experiment

TEXT BOOKS:

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

REFERENCE BOOKS:

1. Artificial Neural Networks - B. Yegnanarayana Prentice Hall of India P Ltd 2005
2. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

B.TECH. AUTOMOBILE ENGINEERING
INTRODUCTION TO MECHATRONICS
(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: AM831OE	**3**	**0**	**0**	**3**

Pre-requisites: Basic Electronics Engineering

Course Objectives:

- To develop an ability to identify, formulate, and solve engineering problems
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes: At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.

UNIT – I

Introduction: Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

Signal Conditioning : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT – II

Precision Mechanical Systems : Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

Electronic Interface Subsystems : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

UNIT – III

Electromechanical Drives : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

Microcontrollers Overview : 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking , Voltage measurement using ADC).

UNIT – IV

Programmable Logic Controllers : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

UNIT – V

Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson.
2. Introduction to Mechatronics / Appukuttan /Oxford

REFERENCE BOOKS:

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill
2. "Designing Intelligent Machines". open University, London.

B.TECH. AUTOMOBILE ENGINEERING
MICROPROCESSORS AND MICROCONTROLLERS
(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: AM832OE	**3**	**0**	**0**	**3**

Course Objectives:

- To develop an understanding of the operations of microprocessors and micro controllers; machine language programming and interfacing techniques.

Course Outcomes:

- Understands the internal architecture and organization of 8086, 8051 and ARM processors/controllers.
- Understands the interfacing techniques to 8086 and 8051 and can develop assembly language programming to design microprocessor/ micro controller based systems.

UNIT - I

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT - II

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

UNIT – III

I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

UNIT – IV

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions,

Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V

Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed.
3. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

REFERENCE BOOKS:

1. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.
2. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
3. The 8051Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.

B.TECH. BIOMEDICAL ENGINEERING
RELIABILITY ENGINEERING
(Open Elective – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: BM511OE	**3**	**0**	**0**	**3**

Prerequisite: Mathematics III

Course Objectives:
- To introduce the basic concepts of reliability, various models of reliability
- To analyze reliability of various systems
- To introduce techniques of frequency and duration for reliability evaluation of repairable systems.

Course Outcomes: After completion of this course, the student will be able to
- model various systems applying reliability networks
- evaluate the reliability of simple and complex systems
- estimate the limiting state probabilities of repairable systems
- apply various mathematical models for evaluating reliability of irrepairable systems

UNIT – I

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.

Definition of Reliability: Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time Between Failures.

UNIT – II

Network Modeling and Evaluation Of Simple Systems: Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems- Series-Parallel systems- Partially redundant systems- Examples.

Network Modeling and Evaluation of Complex systems: Conditional probability method- tie set, Cutset approach- Event tree and reduced event tree methods- Relationships between tie and cutsets- Examples.

UNIT – III

Time Dependent Probability: Basic concepts- Reliability function f(t). F(t), R(t) and h(t) - Relationship between these functions.

Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

UNIT – IV

Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Examples

Continuous Markov Processes: Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems

UNIT – V

Frequency and Duration Techniques: Frequency and duration concepts, application to multi state problems, Frequency balance approach.

Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press, 1983.
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited, 2002.

REFERENCE BOOK:

1. K. K. Agarwal, Reliability Engineering-Kluwer Academic Publishers, 1993**.**

B.TECH. BIOMEDICAL ENGINEERING
MEDICAL ELECTRONICS
(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: BM621OE	**3**	**0**	**0**	**3**

Pre-requisites: Nil.

UNIT - I

Action Potential and Transducers: Electrical activity in cells, tissues, muscles and nervous systems -transducers-types and characteristics

Physiological transducers – pressure transducers-transducers for body temperature measurement – Pulse sensors-respiratory sensors.

UNIT - II

Biosignal Acquisition: Physiological signal amplifiers-isolation amplifiers-medical pre-amplifier design-bridge amplifiers-line driving amplifier-current amplifier – chopper amplifier-biosignal analysis - signal recovery and data acquisition-drift compensation in operational amplifiers-pattern recognition-physiological assist devices.

UNIT - III

Biopotential Recorders: Characteristics of recoding system - electrocardiography (ECG) – electro encephalography (EEG) - electromyography (EMG) - electroretinography (ERG) - electrooculography (EOG) – recorders with high accuracy –recorders for OFF line analysis.

UNIT - IV

Specialized Medical Equipment: Digital thermometer-audio meter –X-ray machines-radiography and fluoroscopy - angiography – elements of bio-telemetry system-design of bio-telemetry system-radio telemetry system-pace makers-Heart lung machine-Dialysis machine.

UNIT - V

Advanced Biomedical Instrumentation: Computers in medicine - lasers in medicine – basic principles of endoscopes- nuclear imaging techniques - computer tomography (CT) Scanning –Ultrasonic imaging system-construction propagation and delay – magnetic resonance imaging (MRI).

TEXT BOOKS:

1. Biomedical Instrumentation and Measurements-L. Cromwell, F.J. Weibel land E. A. Pfeiffer.
2. Biomedical Instrumentation- M. Arumugam - Anuradha Publications.
3. Handbook of Biomedical Instruments- R.S. Khandpur.

B.TECH. BIOMEDICAL ENGINEERING
TELEMETRY AND TELECONTROL
(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: BM831OE	**3**	**0**	**0**	**3**

Pre-requisites: Nil.

Course Objective: To make students understand the application of telemetry techniques to Instrumentation.

Course Outcome: Upon completion of this course students will appreciate t he application of different telemetry systems and control to any process.

UNIT – I

Telemetry Principles: Introduction, Functional blocks of Telemetry system, Methods of Telemetry – Non Electrical, Electrical, Pneumatic, Frequency.

Symbols and Codes: Bits and Symbols, Time function pulses, Line and Channel Coding, Modulation Codes. Inter symbol Interference.

UNIT – II

Frequency& Time Division Multiplexed Systems: FDM, IRIG Standard, FM and PM Circuits, Receiving end, PLL.

TDM - PAM, PAM /PM and TDM – PCM Systems. PCM reception. Differential PCM Introduction, QAM, Protocols.

UNIT – III

Satellite Telemetry: General considerations, TT & C Service, Digital Transmission systems, TT & C Subsystems, Telemetry, and Communications.

Modern Telemetry: Zigbee, Ethernet.

UNIT – IV

Optical Telemetry: Optical fibers Cable – Sources and detectors – Transmitter and Receiving Circuits, Coherent Optical Fiber Communication System.

UNIT – V

Telecontrol Methods: Analog and Digital techniques in Telecontrol, Telecontrol apparatus – Remote adjustment, Guidance, and regulation – Telecontrol using information theory – Example of a Telecontrol System.

TEXT BOOKS:

1. Telemetry Principles – D. Patranabis, TMH

2. Telecontrol Methods and Applications of Telemetry and Remote Control – by Swoboda G., Reinhold Publishing Corp., London, 1991

REFERENCE BOOKS:

1. Handbook of Telemetry and Remote Control – by Gruenberg L., McGraw Hill, New York, 1987.
2. Telemetry Engineering – by Young R.E., Little Books Ltd., London, 1988.
3. Data Communication and Teleprocessing System – by Housley T., PH Intl., Englewood Cliffs, New Jersey, 1987.

B.TECH. BIOMEDICAL ENGINEERING
ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY
(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: BM832OE	**3**	**0**	**0**	**3**

Course Objectives:

- To introduce important system concepts such as Electromagnetic interference and Electromagnetic compatibility (EMI & EMC).
- To familiarize with unavoidable and naturally happening sources of EMI and problems to ensure EMC.
- To study various techniques to reduce EMI from systems and to improve EMC of electronic systems.

Course Outcomes: Upon completion of this course, the student will be able to

- Gain basic knowledge of problems associated with EMI and EMC from electronic circuits and systems.
- Analyze various sources of EMI and various possibilities to provide EMC.
- Understand and analyze possible EMI prevention techniques such as grounding, shielding, filtering, and use of proper coupling mechanisms to improve compatibility of electronic circuits and systems in a given electromagnetic environment.

UNIT – I

Sources of EMI: Definition of EMI and EMC, Classification, Natural and Man-Made EMI Sources, Switching Transients, Electrostatic Discharge, Nuclear Electromagnetic Pulse and High Power Electromagnetics.

EMI/EMC Standards: Introduction, Standards for EMI/EMC – MIL –STD 461/462 – IEEE/ANSI Standards – CISPR/IEC, Standards – FCC Regulations.

UNIT - II

EMI Coupling Modes: Penetration: Introduction, Shielding Theory - Shielding Effectiveness, The Circuit Approach, The Wave Approach, Aperture Theory, Calculation of Effectiveness of a Conducting Box with an Aperture, Introduction to Propagation and Cross Talk – Introduction, Basic Principles, Determination of EM Field from Transmission Lines.

UNIT - III

EMI Controlling Techniques - I: Grounding, Principles and Practice of Earthing, Precautions in Earthing, Measurements of Ground Resistance, System Grounding for EMC, Cable Shielding Grounding.

Shielding, Theory and Effectiveness, Materials, Integrity at Discontinuities, Conductive Coatings, Cable Shielding, Effectiveness Measurements, Electrical Bonding.

UNIT – IV

EMI Controlling Techniques - II: Characteristics and Types of Filters – Impedance Mismatch, Lumped Element Low-Pass, High- Pass, Band-Pass and Band-Reject Filters, Power Line Filter Design - Common Mode, Differential Mode, Combined CM and DM Filters, Design Example.

EMC Gaskets – Knitted Wire-Mesh Gaskets, Wire-Screen Gaskets, Oriented Wire Mesh, Conductive Elastomer, Transparent Conductive Windows, Conductive Adhesive, Conductive Grease, Conductive Coatings, Isolation Transformers, Opto-Isolators.

UNIT - V

EMI Measurements: Introduction to Open Area Test Site Measurements – Measurement Precautions – Open Area Test Site – Terrain Roughness – NSA – Measurement of Test Site Imperfections – Antenna Factor Measurement – Measurement Errors.

Radiated Interference Measurements – Anechoic Chamber – TEM Cell – Reverberating Chamber – Ghz TEM Cell – Comparison of Test Facilities – Measurement Uncertainties

Conducted Interference Measurements – Characterization – Conducted EM Noise on Power Supply Lines – Conducted EMI from Equipment – Immunity – Detectors and Measurement – Pulsed EMI Immunity – Electrostatic Discharge.

TEXT BOOKS:

1. Engineering Electromagnetic Compatibility – V. Prasad Kodali – 2/e – IEEE Press – Wiley India Pvt. Ltd – 2001.

REFERENCES:

1. Introduction to Electromagnetic Compatibility – Clayton R. Paul – John Wiley & Sons, 1992.
2. Electromagnetic Compatibility of Integrated Circuits – Techniques for Low Emission and Susceptibility – Edited by Sonia Ben Dhia, Mohamed Ramdani and Etienne Sicard – Springer, 2006.
3. EMI reduction in Electronic Systems – Mills – J.P – Prentice Hall Inc.
4. Noise Reduction in Electronic Systems – Henry W. Ott, 2nd Edition, Wiley Interscience, 1988.

B.TECH. CIVIL ENGINEERING
DISASTER MANAGEMENT
(Open Elective - I)

	L	T/P/D	C
B.Tech. III Year I Sem			
Course Code: **CE511OE**	3	0/0/0	3

Course Objectives: The subject provide different disasters, tools and methods for disaster management

Course Outcomes: At the end of the course, the student will be able to:

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts and planning of disaster managements

UNIT - I

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

UNIT - II

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT - IV

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India -

Organizational structure for disaster management in India - Preparation of state and district disaster management plans

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

B.TECH. CIVIL ENGINEERING
REMOTE SENSING AND GIS
(Open Elective - II)

	L	T/P/D	C
B.Tech.IV Year II Sem			
Course Code: **CE621OE**	**3**	**0/0/0**	**3**

Pre Requisites: Surveying

Course Objectives: This course will make the student to understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

Course Outcomes: At the end of the course, the student will be able to:

- Retrieve the information content of remotely sensed data
- Analyze the energy interactions in the atmosphere and earth surface features
- Interpret the images for preparation of thematic maps
- Apply problem specific remote sensing data for engineering applications
- Analyze spatial and attribute data for solving spatial problems
- Create GIS and cartographic outputs for presentation

UNIT – I

Introduction to Photogrammetry: Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.

UNIT – II

Remote Sensing: Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process.
Electro-magnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques.

UNIT – III

Geographic Information Systems: Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input- Attribute data Management –Data display- Data Exploration- Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate System: Approximation of the Earth, Datum; Map Projections: Types of Map Projections-Map projection parameters-Commonly used Map Projections - Projected coordinate Systems

UNIT – IV

Vector Data Model: Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules

UNIT – V

Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data.

Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing

TEXT BOOKS:

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

REFERENCES:

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.
3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

B.TECH CIVIL ENGINEERING
GEOINFORMATICS
(Open Elective - II)

	L	T/P/D	C
B.Tech. III Year II Sem			
Course Code: **CE622OE**	**3**	**0/0/0**	**3**

Course Objectives:

- To introduce the concepts of remote sensing, satellite image characteristics and its components.
- To expose the various remote sensing platforms and sensors and to introduce the concepts of GIS, GPS and GNSS.

Course Outcomes: At the end of the course the student will be able to understand

- The characteristics of Aerial photographic images ,Remote sensing satellites and Applications of remote sensing.
- The GIS and its Data models.
- The Global Navigation Satellite System.

UNIT – I

Aerial Photographs- Basic terms & Definitions, scales, relief displacements, Flight Planning, Stereoscopy, Characteristics of photographic images, Fundamentals of aerial photo-interpretation, Introduction to Digital Photogrammetry.

UNIT - II

Remote Sensing: Physics of remote sensing, Remote sensing satellites, and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC

UNIT – III

Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Unsupervised and Supervised Classification, Applications of remote sensing

UNIT - IV

Basic concepts of geographic data, GIS and its components, Data models, Topology, Process in GIS: Data capture, data sources, data encoding, geospatial analysis, GIS Applications

UNIT - V

Global Navigation Satellite System (GNSS), GPS, GLONASS, GALILEO, GPS: Space segment, Control segment, User segment, GPS satellite signals, Datum, coordinate system and map projection, Static, Kinematic and Differential GPS, GPS Applications

TEXT BOOKS:

1. Remote Sensing & GIS , BS Publications
2. Higher Surveying by A M Chandra New Age International Publisher
3. Remote Sensing & GIS by B. Bhatta Oxford University Press
4. Introduction to GPS by A. E Rabbany Library of congress cataloging in Publication data

REFERENCES:

1. T M Lillesand et al: Remote Sensing & Image Interpretation
2. Higher Surveying by B C Punmia Ashok kr. Jain Laxmi Publications
3. N K Agarwal : Essentials of GPS , Spatial Networks: Hyderabad

B.TECH. CIVIL ENGINEERING
INTELLECTUAL PROPERTY RIGHTS
(Open Elective - II)

B.Tech. III Year II Sem	**L**	**T/P/D**	**C**
Course Code: **CE623OE**	**3**	**0/0/0**	**3**

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 trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate McGraw Hill Publishing company ltd.,

B.TECH CIVIL ENGINEERING
ENVIRONMENTAL IMPACT ASSESSMENT
(Open Elective - III)

B.Tech. IV Year II Sem	L	T/P/D	C
Course Code: CE831OE	3	0/0/0	3

Pre Requisites: Environmental Engineering

Course Objectives: This subject will cover various aspects of Environment Impact Assessment methodologies, impact of development activities. Impact on surface water, Air and Biological Environment, Environment legislation Environment.

Course Outcomes:

- Identify the environmental attributes to be considered for the EIA study.
- Formulate objectives of the EIA studies.
- Identify the suitable methodology and prepare Rapid EIA.
- Indentify and incorporate mitigation measures.

UNIT – I

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

UNIT- II

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

UNIT- III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

UNIT – IV

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

UNIT - V

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

TEXT BOOKS:

1. Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications

REFERENCES:

1. Environmental Pollution by R.K. Khitoliya S. Chand, 2014.
2. Glynn, J. and Gary, W. H. K. - Environmental Science and Engineering, Prentice Hall Publishers
3. Suresh K. Dhaneja - Environmental Science and Engineering, S.K. Kataria & Sons Publication. New Delhi.
4. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.
5. Wathern, P. – Environmental Impact Assessment: Theory & Practice, Publishers-Rutledge, London, 1992.

B.TECH. CIVIL ENGINEERING
OPTIMIZATION TECHNIQUES IN ENGINEERING
(Open Elective - III)

B.Tech. IV Year II Sem	**L**	**T/P/D**	**C**
Course Code: **CE832OE**	**3**	**0/0/0**	**3**

Prerequisites: Operations Research

Course Objectives: After doing this subject student should know

- The various optimization techniques for single variable optimization problem
- Direct search methods and Gradient methods for multi variable un constraint Optimization problems
- Formulate a Geometric Programming model and solve it by using Arithmetic Geometric in equality theorem
- Simulate the system
- Thorough of state of art optimization techniques like Genetic Algorithms, simulated Annealing

Course Outcomes: For a given system, as per customer requirement it is required to

- Formulate optimization problem.
- Solve the problem by using a appropriate optimization techniques.

UNIT - I

Single Variable Non-Linear Unconstrained Optimization: Elimination methods: Uni-Model function-its importance, Fibonacci method & Golden section method. Interpolation methods: Quadratic & Cubic interpolation methods.

UNIT - II

Multi variable non-linear unconstrained optimization: Direct search methods – Univariant method, Pattern search methods – Powell's, Hook - Jeeves, Rosen brock search methods. Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.

UNIT - III

Linear Programming – Formulation, Simplex method, & artificial variable optimization techniques: Big M & Two phase methods. Sensitivity analysis: Changes in the objective coefficients, constants& coefficients of the constraints. Addition and deletion of variables, constraints.

Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages

UNIT - IV

Integer Programming- Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method

Stochastic Programming: Basic concepts of probability theory, random variables-distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chance constrained algorithm.

UNIT - V

Geometric Programming: Polynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P (≤ type only)

Non Traditional Optimization Algorithms: Genetics Algorithm-Working Principles, Similarities, and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing- Working Principle-Simple Problems. Introduction to Particle Swarm Optimization (PSO)(very brief)

TEXT BOOKS:

1. Optimization theory & Applications / S. S. Rao / New Age International.
2. Optimization for Engineering Design, Kalyanmoy Deb, PHI

REFERENCES:

1. Operations Research by S. D. Sharma Kedarnath & Ramnath Publisher
2. Operation Research by Hamdy A Taha Pearson Educations
3. Optimization in operations research by Ronald L. Rardin Pearson Publisher
4. Optimization Techniques by Benugundu & Chandraputla, Pearson Asia.
5. Optimization Techniques theory and practice by M. C. Joshi, K. M. Moudgalya Narosa Publications

B.TECH. CIVIL ENGINEERING
ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES
(Open Elective - III)

	L	T/P/D	C
B.Tech. IV Year III Sem			
Course Code: CE833OE	3	0/0/0	3

Course Objective: The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

Course Outcome: It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

Unit – 1: Entrepreneurial Perspectives:
Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

Unit – 2: New Venture Creation:
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

Unit – 3: Management of MSMEs and Sick Enterprises
Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

Units – 4: Managing Marketing and Growth of Enterprises:
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

Units – 5: Strategic perspectives in Entrepreneurship:
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

Text Books:
1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.

2. Entrepreneurship, A South – Asian Perspective, D. F. Kuratko and T.V.Rao, 3e, Cengage, 2012.

REFERENCES:

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING
DISASTER MANAGEMENT
(Open Elective - I)

B.Tech. III Year I Sem	L	T/P/D	C
Course Code: CE511OE	3	0/0/0	3

Course Objectives: The subject provide different disasters, tools and methods for disaster management

Course Outcomes: At the end of the course, the student will be able to:

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts and planning of disaster managements

UNIT - I

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

UNIT - II

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT - IV

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India -

Organizational structure for disaster management in India - Preparation of state and district disaster management plans

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING
ENVIRONMENTAL IMPACT ASSESSMENT
(Open Elective - II)

B.Tech.III Year II Sem	L	T/P/D	C
Course Code: CN621OE	3	0/0/0	3

Pre Requisites: Environmental Engineering

Course Objectives: This subject will cover various aspects of Environment Impact Assessment methodologies, impact of development activities. Impact on surface water, Air and Biological Environment, Environment legislation Environment.

Course Outcomes:

- Identify the environmental attributes to be considered for the EIA study.
- Formulate objectives of the EIA studies.
- Identify the suitable methodology and prepare Rapid EIA.
- Indentify and incorporate mitigation measures.

UNIT – I

Basic concept of EIA : Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

UNIT- II

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

UNIT- III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

UNIT – IV

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

UNIT - V

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

TEXT BOOKS:

1. Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications

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1. Environmental Pollution by R.K. Khitoliya S. Chand, 2014.
2. Glynn, J. and Gary, W. H. K. - Environmental Science and Engineering, Prentice Hall Publishers
3. Suresh K. Dhaneja - Environmental Science and Engineering, S.K. Kataria & Sons Publication. New Delhi.
4. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.
5. Wathern, P. – Environmental Impact Assessment: Theory & Practice, Publishers-Rutledge, London, 1992.

B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING
INTELLECTUAL PROPERTY RIGHTS
(Open Elective - II)

	L	T/P/D	C
B.Tech.III Year II Sem			
Course Code: **CE623OE**	3	0/0/0	3

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 trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate McGraw Hill Publishing company ltd.,

B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING
REMOTE SENSING & GIS
(Open Elective - III)

	L	T/P/D	C
B.Tech. IV Year II Sem			
Course Code: **CN831OE**	**3**	**0/0/0**	**3**

Pre Requisites: Surveying

Course Objectives: This course will make the student to understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

Course Outcomes: At the end of the course, the student will be able to:

- Retrieve the information content of remotely sensed data
- Analyze the energy interactions in the atmosphere and earth surface features
- Interpret the images for preparation of thematic maps
- Apply problem specific remote sensing data for engineering applications
- Analyze spatial and attribute data for solving spatial problems
- Create GIS and cartographic outputs for presentation

UNIT – I

Introduction to Photogrammetry: Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.

UNIT – II

Remote Sensing: Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process.
Electro-magnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques.

UNIT – III

Geographic Information Systems: Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input- Attribute data Management –Data display- Data Exploration- Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate System: Approximation of the Earth, Datum; Map Projections: Types of Map Projections-Map projection parameters-Commonly used Map Projections - Projected coordinate Systems

UNIT – IV

Vector Data Model: Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules

UNIT – V

Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data.

Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing

TEXT BOOKS:

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

REFERENCES:

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.
3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

B.TECH. CIVIL AND ENVIRONMENTAL ENGINEERING
ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES
(Open Elective – III)

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
Course Code: **CE833OE**	**3**	**0/0/0**	**3**

Course Objective: The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

Course Outcome: It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

Unit – 1: Entrepreneurial Perspectives:
Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

Unit – 2: New Venture Creation:
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

Unit – 3: Management of MSMEs and Sick Enterprises
Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

Units – 4: Managing Marketing and Growth of Enterprises:
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

Units – 5: Strategic perspectives in Entrepreneurship:
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

TEXT BOOKS:

1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.

2. Entrepreneurship, A South – Asian Perspective, D. F. Kuratko and T.V. Rao, 3e, Cengage, 2012.

REFERENCES:

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY

OPERATING SYSTEMS
(OPEN ELECTIVE – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: CS511OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the OS role in the overall computer system
- To study the operations performed by OS as a resource manager
- To understand the scheduling policies of OS
- To understand the different memory management techniques
- To understand process concurrency and synchronization
- To understand the concepts of input/output, storage and file management
- To understand the goals and principles of protection
- Introduce system call interface for file and process management
- To study different OS and compare their features.

Course Outcomes:

- Apply optimization techniques for the improvement of system performance.
- Ability to design and solve synchronization problems.
- Learn about minimization of turnaround time, waiting time and response time and also maximization of throughput by keeping CPU as busy as possible.
- Ability to change access controls to protect files.
- Ability to compare the different operating systems.

UNIT - I

Overview-Introduction-Operating system objectives, User view, System view, Operating system definition ,Computer System Organization, Computer System Architecture, OS Structure, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments.

Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

UNIT - II

Process and CPU Scheduling - Process concepts-The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on Processes, System calls-fork(),exec(),wait(),exit(), Interprocess communication-ordinary pipes and named pipes in Unix.

Process Scheduling-Basic concepts, Scheduling Criteria, Scheduling algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Thread scheduling, Linux scheduling and Windows scheduling.

Process Synchronization, Background, The Critical Section Problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization in Linux and Windows.

UNIT - III

Memory Management and Virtual Memory – Memory Management Strategies- Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table, IA-32 Segmentation, IA-32 Paging.

Virtual Memory Management-Background, Demand Paging, Copy-on-Write, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing, Virtual memory in Windows..

UNIT - IV

Storage Management-File System- Concept of a File, System calls for file operations - open (), read (), write (), close (), seek (), unlink (), Access methods, Directory and Disk Structure, File System Mounting, File Sharing, Protection.

File System Implementation - File System Structure, File System Implementation, Directory Implementation, Allocation methods, Free-space Management, Efficiency, and Performance.

Mass Storage Structure – Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap space Management

UNIT - V

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. Operating System Concepts , Abraham Silberschatz, Peter B. Galvin, Greg Gagne, 9th Edition, Wiley, 2016 India Edition
2. Operating Systems – Internals and Design Principles, W. Stallings, 7th Edition, Pearson.

REFERENCE BOOKS:

1. Modern Operating Systems, Andrew S Tanenbaum, 3rd Edition, PHI
2. Operating Systems A concept-based Approach, 2nd Edition, D.M. Dhamdhere, TMH.
3. Principles of Operating Systems, B. L. Stuart, Cengage learning, India Edition.
4. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.
5. Principles of Operating systems, Naresh Chauhan, Oxford University Press.

B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY

DATABASE MANAGEMENT SYSTEMS

(OPEN ELECTIVE – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: CS512OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- To understand the relational database design principles.
- To become familiar with the basic issues of transaction processing and concurrency control.
- To become familiar with database storage structures and access techniques.

Course Outcomes:

- Demonstrate the basic elements of a relational database management system.
- Ability to identify the data models for relevant problems.
- Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
- Apply normalization for the development of application software.

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.

Introduction to Data base design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT - II

Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.

SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION,INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases..

UNIT - III

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT - IV

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.

Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT - V

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education (India) Private Limited, 3rd Edition. **(Part of UNIT-I, UNIT-II, UNIT-III, UNIT-V)**
2. Data base System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw Hill Education(India) Private Limited l, 6th edition.**(Part of UNIT-I, UNIT-IV)**

REFERENCE BOOKS:

1. Database Systems, 6th edition, R Elmasri, Shamkant B.Navathe, Pearson Education.
2. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning.
3. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition.

4. Database Development and Management, Lee Chao, Auerbach publications, Taylor & Francis Group.
5. Introduction to Database Systems, C. J. Date, Pearson Education.

B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY

JAVA PROGRAMMING
(OPEN ELECTIVE – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: CS621OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand object oriented programming concepts, and apply them in problem solving.
- To learn the basics of java Console and GUI based programming.

Course Outcomes:

- Understanding of OOP concepts and basics of java programming (Console and GUI based).
- The skills to apply OOP and Java programming in problem solving.
- Should have the ability to extend his/her knowledge of Java programming further on his/her own.

UNIT- I

OOP concepts – Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms

Java programming - History of Java, comments, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow - block scope, conditional statements, loops, break and continue statements, simple java stand alone programs, arrays, console input and output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection, building strings, exploring string class.

UNIT- II

Inheritance - Inheritance hierarchies, super and sub classes, Member access rules, super keyword, preventing inheritance: final classes and methods, the Object class and its methods

Polymorphism- dynamic binding, method overriding, abstract classes and methods.

Interfaces – Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface.

Inner classes – Uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples.

Packages-Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

UNIT- III

Exception handling – Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re-throwing exceptions, exception specification, built in exceptions, creating own exception sub classes.

Multithreading - Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer pattern.

UNIT- IV

Collection Framework in Java – Introduction to Java Collections, Overview of Java Collection frame work, Generics, Commonly used Collection classes– Array List, Vector, Hash table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, calendar and Properties

Files – streams- byte streams, character streams, text Input/output, binary input/output, random access file operations, File management using File class.

Connecting to Database - JDBC Type 1 to 4 drivers, connecting to a database, querying a database and processing the results, updating data with JDBC.

UNIT- V

GUI Programming with Java - The AWT class hierarchy, Introduction to Swing, Swing vs. AWT, Hierarchy for Swing components, Containers – JFrame, JApplet, JDialog, JPanel, Overview of some swing components- Jbutton, JLabel, JTextField, JTextArea, simple swing applications, Layout management - Layout manager types – border, grid and flow

Event handling - Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, Examples: handling a button click, handling mouse events, Adapter classes.

Applets – Inheritance hierarchy for applets, differences between applets and applications, life cycle of an applet, passing parameters to applets, applet security issues.

TEXT BOOK:

1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.

REFERENCE BOOKS:

1. Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M.Deitel, PHI.
2. Object Oriented Programming through Java, P.Radha Krishna, Universities Press.
3. Thinking in Java, Bruce Eckel, Pearson Education
4. Programming in Java, S.Malhotra and S.Choudhary, Oxford Univ. Press.

B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY

SOFTWARE TESTING METHODOLOGIES

(OPEN ELECTIVE – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: CS622OE	**3**	**0**	**0**	**3**

Course Objectives:

To understand the software testing methodologies such as flow graphs and path testing, transaction flows testing, data flow testing, domain testing and logic base testing.

Course Outcomes:

- Ability to apply the process of testing and various methodologies in testing for developed software.
- Ability to write test cases for given software to test it before delivery to the customer.

UNIT - I

Introduction:- Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.

Flow graphs and Path testing:- Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II

Transaction Flow Testing:-transaction flows, transaction flow testing techniques.

Dataflow testing:- Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

UNIT - III

Domain Testing:-domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT-IV

Paths, Path products and Regular expressions:- path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing:- overview, decision tables, path expressions, kv charts, specifications.

UNIT - V

State, State Graphs and Transition testing:- state graphs, good & bad state graphs, state testing, Testability tips.

Graph Matrices and Application:-Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

TEXT BOOKS:

1. Software Testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr.K.V.K.K.Prasad, Dreamtech.

REFERENCE BOOKS:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing,3rd edition,P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
3. Software Testing, N.Chauhan, Oxford University Press.
4. Introduction to Software Testing, P.Ammann&J.Offutt, Cambridge Univ.Press.
5. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.
6. Software Testing Concepts and Tools, P.Nageswara Rao, dreamtech Press.
7. Software Testing, M.G.Limaye, TMH.
8. Software Testing, S.Desikan, G.Ramesh, Pearson.
9. Foundations of Software Testing, D.Graham & Others, Cengage Learning.
10. Foundations of Software Testing, A.P.Mathur, Pearson.

B.TECH COMPUTER SCIENCE AND ENGINEERING / B.TECH INFORMATION TECHNOLOGY

CYBER SECURITY

(OPEN ELECTIVE – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: CS623OE	**3**	**0**	**0**	**3**

UNIT- I

Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT - II

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT IV

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT V

Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOK:

1. **Cyber Security:** *Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Nina Godbole and Sunil Belapure, Wiley INDIA.

REFERENCE BOOK:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group

B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY

LINUX PROGRAMMING
(OPEN ELECTIVE – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: CS831OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand and make effective use of Linux utilities and Shell scripting language (bash) to solve Problems.
- To implement in C some standard Linux utilities such as ls, mv, cp etc. using system calls.
- To develop the skills necessary for systems programming including file system programming, process and signal management, and interprocess communication.
- To develop the basic skills required to write network programs using Sockets.

Course Outcomes:

- Work confidently in Linux environment.
- Work with shell script to automate different tasks as Linux administration.

UNIT- I

Linux Utilities - File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities.
Sed-Scripts, Operation, Addresses, Commands, Applications, awk-Execution, Fields and Records, Scripts, Operation, Patterns, Actions, Associative Arrays, String and Mathematical functions, System commands in awk, Applications.
Shell programming with Bourne again shell (bash) - Introduction, shell responsibilities, pipes and Redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

UNIT- II

Files and Directories - File Concept, File types, File System Structure, file metadata-Inodes, kernel support for files, system calls for file I/O operations- open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking- fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, fchown, links-soft links and hard links – symlink, link, unlink. **Directories** - Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions.

UNIT- III

Process – Process concept, Layout of a C program image in main memory, Process environment-environment list, environment variables, getenv, setenv, Kernel support for process, process identification, process control - process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process, system call interface for process management-fork, vfork, exit, wait, waitpid, exec family, Process Groups, Sessions and Controlling Terminal, Differences between threads and processes.

Signals – Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise, alarm, pause, abort, sleep functions.

UNIT- IV

Interprocess Communication - Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pipes-creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs (Named pipes), differences between unnamed and named pipes, popen and pclose library functions. **Message Queues** - Kernel support for messages, APIs for message queues, client/server example. **Semaphores** - Kernel support for semaphores, APIs for semaphores, file locking with semaphores.

UNIT- V

Shared Memory - Kernel support for shared memory, APIs for shared memory, shared memory example. **Sockets** - Introduction to Berkeley Sockets, IPC over a network, Client-Server model, Socket address structures (Unix domain and Internet domain),Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs-Single Server-Client connection, Multiple simultaneous clients, Socket options-setsockopt and fcntl system calls, Comparison of IPC mechanisms.

TEXT BOOKS:

1. Unix System Programming using C++, T. Chan, PHI.
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
3. Unix Network Programming, W. R. Stevens, PHI.

REFERENCE BOOKS:

1. Beginning Linux Programming, 4th Edition, N. Matthew, R. Stones, Wrox, Wiley India Edition.
2. Unix for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson.
3. System Programming with C and Unix, A. Hoover, Pearson.
4. Unix System Programming, Communication, Concurrency and Threads, K. A. Robbins and S. Robbins, Pearson Education.
5. Unix shell Programming, S. G. Kochan and P. Wood, 3rd edition, Pearson Education.

6. Shell Scripting, S. Parker, Wiley India Pvt. Ltd.
7. Advanced Programming in the Unix Environment, 2nd edition, W. R. Stevens and S. A. Rago, Pearson Education.
8. Unix and Shell programming, B. A. Forouzan and R. F. Gilberg, Cengage Learning.
9. Linux System Programming, Robert Love, O'Reilly, SPD.
10. C Programming Language, Kernighan and Ritchie, PHI

B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY

R PROGRAMMING
(OPEN ELECTIVE – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: CS832OE	**3**	**0**	**0**	**3**

Course Objectives:

- Understanding and being able to use basic programming concepts
- Automate data analysis
- Working collaboratively and openly on code
- Knowing how to generate dynamic documents
- Being able to use a continuous test-driven development approach

Course Outcomes:

- be able to use and program in the programming language R
- be able to use R to solve statistical problems
- be able to implement and describe Monte Carlo the technology
- be able to minimize and maximize functions using R

UNIT – I

Introduction: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

UNIT – II

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes

Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

UNIT – III

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations

UNIT - IV

FACTORS AND TABLES, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

UNIT - V

OBJECT-ORIENTED PROGRAMMING: S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation

TEXT BOOKS:

1. R Programming for Data Science by Roger D. Peng
2. The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India**.**

B.TECH COMPUTER SCIENCE AND ENGINEERING/B.TECH INFORMATION TECHNOLOGY

PHP PROGRAMMING

(OPEN ELECTIVE – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: CS833OE	**3**	**0**	**0**	**3**

Course Objectives:

- Gain the PHP programming skills needed to successfully build interactive, data-driven sites
- Use the MVC pattern to organize code
- Test and debug a PHP application
- Work with form data
- Use cookies and sessions
- Work with regular expressions, handle exceptions, and validate data

Course Outcomes:

- Be able to develop a form containing several fields and be able to process the data provided on the form by a user in a PHP-based script.
- Understand basic PHP syntax for variable use and standard language constructs, such as conditionals and loops.
- Understand the syntax and use of PHP object-oriented classes.
- Understand the syntax and functions available to deal with file processing for files on the server as well as processing web URLs.
- Understand the paradigm for dealing with form-based data, both from the syntax of HTML forms, and how they are accessed inside a PHP-based script.

Unit - I:

INTRODUCTION TO PHP: History of PHP, Apache Web Server, MySQL and Open Source, Relationship between Apache, MySQL and PHP (AMP Module), PHP configuration in IIS, Apache Web server

BASICS OF PHP: PHP structure and syntax, Creating the PHP pages, Rules of PHP syntax, Integrating HTML with PHP, Constants, Variables : static and global variable, Conditional Structure & Looping, PHP Operators, Arrays, for each constructs, User defined function, argument function, Variable function, Return Function, default argument, variable length argument.

Unit - II:

WORKING WITH FUNCTIONS: Variable Function, String Function, Math Function, Date Function, Array Function, and File Function. User defined function, Systems defined

function, Parameterized function, Non parameterized function, Dynamic parameter in function, Variable scope, Passing Argument in function, Static function.

Unit - III:

WORKING WITH DATA: FORM element, INPUT elements, Processing the form, User Input, Adding items, Validating the user input, Passing variables between pages. Files, Creating and deleting file, Reading and writing file, Working with file, Creating and deleting folder, Working with regular Expression Basic regular expression, Matching patterns, Finding match, Replace match,

Unit - IV:

ERROR HANDLING: Error types in PHP, Generating PHP errors, Exceptions, Parse errors, State Management: - Cookies Session, Destroying cookies and session Http management, Sent mail

Images with PHP: Working with GD Library, File types with GD and PHP, Compiling PHP with GD, Creating the image table, uploading the image.

Unit - V:

INTRODUCTION TO MYSQL: MySQL structure and syntax, Types of MySQL tables and storages engines, MySQL commands, Integration of PHP with MySQL, Connection to the MySQL server, Working with PHP and arrays of data, Referencing two tables, Joining two tables.

WORKING WITH DATABASE: Creating a table, manipulating the table, editing the database, inserting a record, deleting a record, editing data

Understand process of executing a PHP-based script on a webserver.

TEXT BOOKS:

1. **Beginning PHP, Apache, MySQL Web Development -** Elizabeth Naramore, Jason Gerner, Yann Le, Scouarnec, Jeremy Stolz, Michael K. Glass, Gary Mailer - By Wrox Publication.
2. **PHP, MySQL and Apache** - Julie C. Melone By Pearson Education

REFERENCE BOOKS:

1. **Beginning PHP 5.3,** by Matt Doyle - By Wrox Publication
2. **PHP and MySQL Bible** – Tim Converse and Joyce Park with Clark Morgam By Wiley INDIA

B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING / B.TECH ELECTRONICS AND TELEMATICS ENGINEERING
PRINCIPLES OF ELECTRONIC COMMUNICATIONS
(OPEN ELECTIVE - I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: EC511OE	**3**	**0**	**0**	**3**

Course Objectives: The objective of this subject is to:

- Introduce the students to modulation and various analog and digital modulation schemes.
- They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Outcomes: By completing this subject, the student can

- Work on various types of modulations.
- Should be able to use these communication modules in implementation.
- Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.

UNIT - I

Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT - II

Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

UNIT - III

Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.

Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT - IV

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT - V

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.

Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Electronic Communications systems, Kennedy, Davis 4e, MC GRAW HILL EDUCATION, 1999

Reference Books:

1. Theodore Rapp port, Wireless Communications - Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Introduction to data communications and networking, Wayne Tomasi, Pearson Education, 2005.

B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING / B.TECH ELECTRONICS AND TELEMATICS ENGINEERING
PRINCIPLES OF COMPUTER COMMUNICATIONS AND NETWORKS (OPEN ELECTIVE - II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: EC621OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the concept of computer communication.
- To learn about the networking concept, layered protocols.
- To understand various communications concepts.
- To get the knowledge of various networking equipment.

Course Outcomes:

- The student can get the knowledge of networking of computers, data transmission between computers.
- Will have the exposure about the various communication concepts.
- Will get awareness about the structure and equipment of computer network structures.

UNIT - I

Overview of Computer Communications and Networking: Introduction to Computer Communications and Networking, Introduction to Computer Network, Types of Computer Networks, Network Addressing, Routing, Reliability, Interoperability and Security, Network Standards, The Telephone System and Data Communications.

UNIT - II

Essential Terms and Concepts: Computer Applications and application protocols, Computer Communications and Networking models, Communication Service Methods and data transmission modes, analog and Digital Communications , Speed and capacity of a Communication Channel, Multiplexing and switching, Network architecture and the OSI reference model.

UNIT - III

Analog and Digital Communication Concepts: Representing data as analog signals, representing data as digital signals, data rate and bandwidth reduction, Digital Carrier Systems.

UNIT - IV

Physical and data link layer Concepts: The Physical and Electrical Characteristics of wire, Copper media, fiber optic media, wireless Communications. Introduction to data link Layer , the logical link control and medium access control sub-layers.

UNIT - V

Network Hardware Components: Introduction to Connectors, Transreceivers and media convertors, repeaters, network interference cards and PC cards, bridges, switches, switches Vs Routers.

TEXT BOOKS:

1. Computer Communications and Networking Technologies, Michel A. Gallo and William H. Hancock, Thomson Brooks / Cole.
2. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition MC GRAW HILL EDUCATION, 2006.

REFERENCE BOOKS:

1. Principles of Computer Networks and Communications, M. Barry Dumas, Morris Schwartz, Pearson.
2. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING / B.TECH ELECTRONICS AND TELEMATICS ENGINEERING
ELECTRONIC MEASURING INSTRUMENTS
(OPEN ELECTIVE - III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: EC831OE	**3**	**0**	**0**	**3**

Note: No detailed mathematical treatment is required.

Course Objectives:

- It provides an understanding of various measuring systems functioning and metrics for performance analysis.
- Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
- Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes: On completion of this course student can be able to

- Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.
- Measure various physical parameters by appropriately selecting the transducers.
- Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

UNIT - I

Block Schematics of Measuring Systems and Performance Metrics: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag.

UNIT - II

Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, and Specifications.

UNIT - III

Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments. CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes.

UNIT - IV

Recorders: X-Y Plotter, Curve tracer, Galvanometric Recorders, Servo transducers, pen driving mechanisms, Magnetic Recording, Magnetic recording techniques.

UNIT - V

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

TEXT BOOKS:

1. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

REFERENCES:

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

B.TECH. ELECTRONICS AND COMPUTER ENGINEERING
SCRIPTING LANGUAGES
(Open Elective – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: EM511OE	**3**	**0**	**0**	**3**

Course Objectives: The goal of the course is to study:

- The principles of scripting languages.
- Motivation for and applications of scripting.
- Difference between scripting languages and non- scripting languages.
- Types of scripting languages.
- Scripting languages such as PERL, TCL/TK, python and BASH.
- Creation of programs in the Linux environment.
- Usage of scripting languages in IC design flow.

Course Outcomes:

Upon learning the course, the student will have the:

- Ability to create and run scripts using PERL/TCl/Python in IC design flow.
- Ability to use Linux environment and write programs for automation of scripts in VLSI tool design flow.

UNIT –I:

Linux Basics:

Introduction to Linux , File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts.

UNIT –II :

Linux Networking:

Introduction to Networking in Linux, Network basics & Tools, File Transfer Protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.

UNIT –III :

Perl Scripting:

Introduction to Perl Scripting, working with simple values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting, References & Subroutines, Running and Debugging Perl, Modules, Object – Oriented Perl.

UNIT –IV:

Tcl / Tk Scripting:

Tcl Fundamentals, String and Pattern Matching, Tcl Data Structures, Control Flow Commands, Procedures and Scope, Evel, Working with Unix, Reflection and Debugging, Script Libraries, Tk Fundamentals, Tk by examples, The Pack Geometry Manager, Binding Commands to X Events, Buttons and Menus, Simple Tk Widgets, Entry and List box Widgets Focus, Grabs and Dialogs.

UNIT –V :

Python Scripting:

Introduction to Python, using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.

TEXT BOOKS:

1. Python Tutorial by Guido Van Rossum, Fred L. Drake Jr. editor , Release 2.6.4
2. Practical Programming in Tcl and Tk by Brent Welch, Updated for Tcl 7.4 and Tk 4.0.
3. Teach Yorself Perl in 21 days by David Till.
4. Red Hat Enterprise Linux 4 : System Administration Guide Copyright, 2005 Red Hat Inc.

REFERENCE BOOKS:

1. Learning Python – 2nd Ed., Mark Lutz and David Ascher, 2003, O'Reilly.
2. Perl in 24 Hours – 3rd Ed., Clinton Pierce, 2005, Sams Publishing.
3. Learning Perl – 4th Ed. Randal Schwartz, Tom Phoenix and Brain d foy. 2005.
4. Jython Essentials – Samuele Pedroni and Noel Pappin.2002. O'Reilly.
5. Programming Perl – Larry Wall, Tom Christiansen and John Orwant, 3rd Edition, O'Reilly, 2000. (ISBN 0596000278)

B.TECH. ELECTRONICS AND COMPUTER ENGINEERING
SOFT COMPUTING TECHNIQUES
(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: EM621OE	**3**	**0**	**0**	**3**

Prerequisite: Nil.

Course Objectives: This course makes the students to Understand

- Fundamentals of Neural Networks & Feed Forward Networks.
- Associative Memories & ART Neural Networks.
- Fuzzy Logic & Systems.
- Genetic Algorithms and Hybrid Systems.

Course Outcomes: On completion of this course the students will be able to

- Identify and employ suitable soft computing techniques in classification and optimization problems.
- Design hybrid systems to suit a given real – life problem.

UNIT –I:

Fundamentals of Neural Networks & Feed Forward Networks:

Basic Concept of Neural Networks, Human Brain, Models of an Artificial Neuron, Learning Methods, Neural Networks Architectures, Single Layer Feed Forward Neural Network :The Perceptron Model, Multilayer Feed Forward Neural Network :Architecture of a Back Propagation Network (BPN), The Solution, Back propagation Learning, Selection of various Parameters in BPN. Application of Back propagation Networks in Pattern Recognition & Image Processing.

UNIT –II:

Associative Memories & ART Neural Networks:

Basic concepts of Linear Associator, Basic concepts of Dynamical systems, Mathematical Foundation of Discrete-Time Hop field Networks(HPF), Mathematical Foundation of Gradient-Type Hopfield Networks, Transient response of Continuous Time Networks, Applications of HPF in Solution of Optimization Problem: Minimization of the Traveling salesman tour length, Summing networks with digital outputs, Solving Simultaneous Linear Equations, Bidirectional Associative Memory Networks; Cluster Structure, Vector Quantization, Classical ART Networks, Simplified ART Architecture.

UNIT –III:

Fuzzy Logic & Systems:

Fuzzy sets, Crisp Relations, Fuzzy Relations, Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based system, Defuzzification Methods, Applications: Greg Viot's Fuzzy Cruise Controller, Air Conditioner Controller.

UNIT –IV:

Genetic Algorithms:

Basic Concepts of Genetic Algorithms (GA), Biological background, Creation of Offsprings, Working Principle, Encoding, Fitness Function, Reproduction, Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operators used in GA, Generational Cycle, Convergence of Genetic Algorithm.

UNIT –V:

Hybrid Systems:

Types of Hybrid Systems, Neural Networks, Fuzzy Logic, and Genetic Algorithms Hybrid, Genetic Algorithm based BPN: GA Based weight Determination, Fuzzy Back Propagation Dept. of ECE, JNTUHCEH M.Tech. (SSP) (FT) w.e.f. 2015-16 56 Networks: LR-type fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BPN, Inference by fuzzy BPN.

TEXT BOOKS:

1. Introduction to Artificial Neural Systems - J.M.Zurada, Jaico Publishers
2. Neural Networks, Fuzzy Logic & Genetic Algorithms: Synthesis & Applications - S.Rajasekaran, G.A. Vijayalakshmi Pai, July 2011, PHI, New Delhi.
3. Genetic Algorithms by David E. Gold Berg, Pearson Education India, 2006.
4. Neural Networks & Fuzzy Sytems- Kosko.B., PHI, Delhi,1994.

REFERENCE BOOKS:

1. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
2. An introduction to Genetic Algorithms - Mitchell Melanie, MIT Press, 1998
3. Fuzzy Sets, Uncertainty and Information- Klir G.J. & Folger. T. A., PHI, Delhi, 1993

B.TECH. ELECTRONICS AND COMPUTER ENGINEERING
DATA ANALYTICS
(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: EM831OE	**3**	**0**	**0**	**3**

Prerequisite: Nil

Course Objectives: The student should be made to :

- Be exposed to conceptual frame work of big data.
- Understand different techniques of Data Analysis.
- Be familiar with concepts of data streams.
- Be exposed to item sets, Clustering, frame works and Visualization.

Course Outcomes: Upon completion of this course the students will be able to

- Understand Big data fundamentals.
- Learn various Data Analysis Techniques
- Implement various Data streams.
- Understand item sets, Clustering, frame works & Visualizations.

UNIT – I

Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability , analytic process and tools , Analysis vs Reporting – Modern data analytic tools, stastical concepts : Sampling distributions, resampling , statistical inference, prediction error.

UNIT – II

Data Analysis: Regression modeling , Multivariate analysis, Bayesian modeling , inference and Bayesian networks , Support vector and Kernel methods, Analysis of time series : Linear systems analysis , nonlinear dynamics – Rule induction – Neural networks : Learning and and Generalisation, competitive learning, Principal component analysis and neural networks ; Fuzzy Logic : extracting fuzzy models from data , fuzzy decision trees, Stochastic search methods.

UNIT – III

Mining Data Streams: Introduction to Streams Concepts – Stream data model and architecture – Stream Computing , Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a Window – Decaying window – Real time Analytics Platform (RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

UNIT – IV

Frequent Itemsets and clustering: Mining Frequent itemsets – Market based Modeling – Apriori Algorithm – Handling large data sets in Main Memory – Limited Pass Algorithm – Counting frequent itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means – Clustering high dimensional data – CLIQUE and ProCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

UNIT – V

Frame Works and Visualization: MapReduce – Hadoop, Hive , MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques, interaction techniques : systems and Applications .

TEXT BOOKS:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

REFERENCE BOOKS:

1. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
2. Glenn J. Myatt, Making Sense of Data, John Wiley & sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
3. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
NON-CONVENTIONAL POWER GENERATION
(OPEN ELECTIVE – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: EE511OE	**3**	**0**	**0**	**3**

Prerequisite: Nil.

Course Objectives:

- To introduce various types of renewable energy technologies
- To understand the technologies of energy conversion from the resources and their quantitative analysis.

Course Outcomes: After completion of this course, the student will be able to

- Analyze solar thermal and photovoltaic systems and related technologies for energy conversion.
- Understand Wind energy conversion and devices available for it.
- Understand Biomass conversion technologies, Geo thermal resources and energy conversion principles and technologies.
- Realize Power from oceans (thermal, wave, tidal) and conversion devices.
- Understand fundamentals of fuel cells and commercial batteries.

UNIT - I

Fundamentals of Solar Energy-Solar spectrum- Solar Radiation on Earth's surface-Solar radiation geometry-Solar radiation measurements- Solar radiation data- Solar radiation on horizontal and tilted surfaces. Solar Thermal conversion- Flat plate collectors- concentrated collectors- construction and thermal analysis- Solar applications- Solar ponds- Heliostat systems-water heater-air heater-solar still.

UNIT - II

Solar-Electric Power generation- Photovoltaic cells- Equivalent circuit- V-I Characteristics- Photovoltaic modules – constructional details- design considerations- Tracking- Maximum power point tracking - Solar Thermo electric conversion.

UNIT - III

Wind Energy- Fundamentals of wind energy-power available in wind- Betz Limit- Aerodynamics of wind turbine- Wind turbines- Horizontal and vertical axis turbines –their configurations- Wind Energy conversion systems.

UNIT - IV

Energy from Bio Mass- Various fuels- Sources-Conversion technologies-Wet Processes – Dry Processes- Bio Gas generation – Aerobic and anaerobic digestion - Factors affecting generation of bio gas - Classification of bio gas plants-Different Indian digesters- Digester design considerations - Gasification process - Gasifiers – Applications. Geothermal Energy - sources- Hydrothermal convective - Geo-pressure resources - Petro-thermal systems (HDR) - Magma Resources-Prime Movers.

UNIT - V

OTEC Systems- Principle of operation - Open and closed cycles, Energy from Tides - Principle of Tidal Power - Components of tidal Power plants - Operation Methods - Estimation of Energy in Single and double basin systems - Energy and Power from Waves- Wave energy conversion devices - Fuel Cells - Design and Principle of operation - Types of Fuel Cells - Advantages and disadvantages - Types of Electrodes – Applications - Basics of Batteries - Constructional details of Lead acid batteries - Ni-Cd Batteries.

TEXT BOOKS:

1. "John Twidell & Wier", "Renewable Energy Resources", CRC Press, 2009.
2. "G. D. Rai", "Non Conventional Energy sources", Khanna publishers, 2004

REFERENCE BOOKS:

1. "D. P .Kothari, Singal, Rakesh and Ranjan", "Renewable Energy sources and Emerging Technologies", PHI, 2009.
2. "F. C. Treble", Generating Electricity from Sun, Pergamon Press, 1st Edition 1991
3. "C. S. Solanki", "Solar Photovoltaics - Fundamentals- Principles and Applications", PHI, 2009
4. "S. P. Sukhatme", "Solar Energy Principles and Application", TMH, 2009.

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
ELECTRICAL ENGINEERING MATERIALS
(OPEN ELECTIVE – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: EE512OE	**3**	**0**	**0**	**3**

Prerequisite: Engineering chemistry and Engineering Physics - II

Course Objective:

- To understand the importance of various materials used in electrical engineering and obtain a qualitative analysis of their behavior and applications.

Course Outcomes: After completion of this course, the student will be able to

- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Acquire Knowledge on Materials used in electrical engineering and applications.

UNIT- I

Dielectric Materials: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT – II

Magnetic Materials: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis

UNIT – III

Semiconductor Materials: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI)

UNIT – IV

Materials for Electrical Applications: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT – V

Special Purpose Materials: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI

Text Books:

1. "R K Rajput", " A course in Electrical Engineering Materials", Laxmi Publications, 2009
2. "T K Basak", " A course in Electrical Engineering Materials", New Age Science Publications 2009

Reference Books:

1. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.
2. "AdrianusJ.Dekker", Electrical Engineering Materials, PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", Dhanpat Rai & Sons, 2011.

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING
NANOTECHNOLOGY
(OPEN ELECTIVE – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: EE513OE	**3**	**0**	**0**	**3**

Course Objectives: Nano Technology is one of the core subjects of multidisciplinary nature. This has extensive applications in the field of energy, electronics, Biomedical Engg. Etc. Built to specifications by manufacturing matter on the atomic scale, the Nano products would exhibit an order of magnitude improvement in strength, toughness, and efficiency. The objective here is imparting the basic knowledge in Nano Science and Technology.

Course Outcomes: The present syllabus of "Introduction to Nano Technology" will give insight into many aspects of Nanoscience, technology and their applications in the prospective of materials science.

UNIT - I

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges, and Future Prospects.

UNIT - II

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and disclinations,

Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility.

Magnetic Properties: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

UNIT- III

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, **Consolidation of Nanopowders**: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

UNIT - IV

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope

(STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

UNIT - V

Applications 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, Defense and Space Applications, Concerns and challenges of Nanotechnology.

TEXT BOOKS:

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES BOOKS:

1. Nano: The Essentials by T. Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L. Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S., S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
DESIGN ESTIMATION AND COSTING OF ELECTRICAL SYSTEMS
(OPEN ELECTIVE – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: EE621OE	**3**	**0**	**0**	**3**

Prerequisite: Power systems - I & Power Systems - II

Course Objectives:

- To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
- To design and estimation of wiring
- To design overhead and underground distribution lines, substations and illumination

Course Outcomes: After Completion of this course, student will be able to

- Understand the design considerations of electrical installations.
- Design electrical installation for buildings and small industries.
- Identify and design the various types of light sources for different applications.

UNIT - I

Design Considerations of Electrical Installations: Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, Earthing, General requirements of electrical installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections , Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT - II

Electrical Installation for Different Types of Buildings and Small Industries: Electrical installations for residential buildings – estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.

UNIT - III

Overhead and Underground Transmission and Distribution Lines: Introduction, Supports for transmission lines, Distribution lines – Materials used, Underground cables, Mechanical Design of overhead lines, Design of underground cables.

UNIT - IV

Substations: Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

UNIT - V

Design of Illumination Schemes: Introduction, Terminology in illumination, laws of illumination, various types of light sources, Practical lighting schemes LED, CFL and OCFL differences.

Text Books:

1. "K. B. Raina, S. K. Bhattacharya", "Electrical Design Estimating and Costing", New Age International Publisher, 2010.
2. "Er. V. K. Jain, Er. Amitabh Bajaj", "Design of Electrical Installations", University Science Press.

Reference Books:

1. Code of practice for Electrical wiring installations,(System voltage not exceeding 650 volts), Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical layout in residential buildings, Indian Standard Institution, IS: 4648-1968.
3. Electrical Installation buildings Indian Standard Institution, IS: 2032.
4. Code of Practice for selection, Installation of Maintenance of fuse (voltage not exceeding 650 V), Indian Standard Institution, IS: 3106-1966.
5. Code of Practice for earthling, Indian Standard Institution, IS: 3043-1966.
6. Code of Practice for Installation and Maintenance of induction motors, Indian Standard Institution, IS: 900-1965.
7. Code of Practice for electrical wiring, Installations (system voltage not exceeding 650 Volts), Indian Standard Institution, IS: 2274-1963.
8. "Gupta J. B., Katson, Ludhiana", "Electrical Installation, estimating and costing", S. K. Kataria and sons, 2013.

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
ENERGY STORAGE SYSTEMS
(OPEN ELECTIVE – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: EE622OE	**3**	**0**	**0**	**3**

Prerequisite: Electro chemistry

Course Objective:

- To enable the student to understand the need for energy storage, devices and technologies available and their applications

Course Outcomes: After completion of this course, the student will be able to

- analyze the characteristics of energy from various sources and need for storage
- classify various types of energy storage and various devices used for the purpose
- Identify various real time applications.

UNIT - I

Electrical Energy Storage Technologies: Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

UNIT - II

Needs for Electrical Energy Storage: Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The roles from the viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.

UNIT - III

Features of Energy Storage Systems: Classification of EES systems , Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES),Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2),Synthetic natural gas (SNG).

UNIT - IV

Types of Electrical Energy Storage systems: Electrical storage systems, Double-layer capacitors (DLC) ,Superconducting magnetic energy storage (SMES),Thermal storage systems ,Standards for EES, Technical comparison of EES technologies.

UNIT - V

Applications: Present status of applications, Utility use (conventional power generation, grid operation & service) , Consumer use (uninterruptable power supply for large consumers), New trends in applications ,Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems, External connection of EES systems , Aggregating EES systems and distributed generation (Virtual Power Plant), Battery SCADA–aggregation of many dispersed batteries.

Text Books:

1. "James M. Eyer, Joseph J. Iannucci and Garth P. Corey ", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board.

Reference Book:

1. "Jim Eyer, Garth Corey", Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
INTRODUCTION TO MECHATRONICS
(OPEN ELECTIVE – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: EE623OE	**3**	**0**	**0**	**3**

Pre-requisites: Basic Electronics Engineering

Course Objectives:

- To develop an ability to identify, formulate, and solve engineering problems
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes: At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.

UNIT – I

Introduction: Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

Signal Conditioning : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT – II

Precision Mechanical Systems : Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

Electronic Interface Subsystems : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC’s - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

UNIT – III

Electromechanical Drives : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

Microcontrollers Overview : 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking, Voltage measurement using ADC).

UNIT – IV

Programmable Logic Controllers : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

UNIT – V

Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson.
2. Introduction to Mechatronics / Appukuttan /Oxford

REFERENCE BOOKS:

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill
2. "Designing Intelligent Machines". open University, London.

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
ENTREPRENEUR RESOURCE PLANNING
(OPEN ELECTIVE – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: EE831OE	**3**	**0**	**0**	**3**

(Students must read text book. Faculty is free to choose any other cases)

Course Objectives: It enables the student to understand the foundations of Enterprise planning and ERP System Options.

Course Outcome: The student understands the challenges in implementation of ERP system, ERP System Implementation options, and functional modules of ERP.

1. Introduction to ERP- Foundation for Understanding ERP systems-Business benefits of ERP-The challenges of implementing ERP system-ERP modules and Historical Development.

Case: Response top RFP for ban ERP system (Mary Sumner).

2. ERP system options & Selection methods-Measurement of project Inpact-information Technology Selection-ERP proposal evaluation-Project Evaluation Technique.(David L. olson).

Case: Atlantic Manufacturing (Mary Sumner).

3. ERP system Installation Options- IS/IT Management results-Risk Identification analysis-System Projects- Demonstration of the system-Failure method-system Architecture & ERP (David L. Olson)

Case: Data Solutions & Technology Knowledge (Mary Sumner).

4. ERP - sales and Marketing- Management control process in sales and marketing - ERP customer relationship management - ERP systems- Accounting & Finance control processes. Financial modules in ERP systems.

Case: Atlantic manufacturing (Mary Sumner).

5. ERP – Production and Material Management-Control process on production and manufacturing - Production module in ERP- supply chain Management & e-market place-e-business & ERP-e supply chain & ERP- Future directions for ERP.

Case: HR in Atlantic manufacturing. (Mary Sumner).

UNIT - I

ERP and Technology: Introduction – Related Technologies – Business Intelligence – E-Commerce and E Business – Business Process Reengineering – Data Warehousing – Data Mining – OLAP – Product life Cycle management – SCM – CRM

UNIT - II

ERP Implementation: Implementation Challenges – Strategies – Life Cycle – Pre-implementation Tasks –Requirements Definition – Methodologies – Package selection –

Project Teams –Process Definitions – Vendors and Consultants – Data Migration – Project management – Post Implementation Activities.

UNIT - III

ERP In Action & Business Modules: Operation and Maintenance – Performance – Maximizing the ERP System – Business Modules – Finance – Manufacturing – Human Resources – Plant maintenance –Materials Management – Quality management – Marketing – Sales, Distribution and service.

UNIT - IV

ERP Market: Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc –SSA Global – Lawson Software – Epicor – Intutive.

UNIT - V

Enterprise Application Integration – ERP and E-Business – ERP II – Total quality management – Future Directions – Trends in ERP.

TEXT BOOKS:

1. Alexis Leon, “ERP DEMYSTIFIED”, Tata McGraw Hill, Second Edition, 2008.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.

REFERENCE BOOKS:

1. Jim Mazzullo, “SAP R/3 for Everyone”, Pearson, 2007.
2. Jose Antonio Fernandz, “The SAP R /3 Handbook”, Tata McGraw Hill, 1998.
3. Biao Fu, “SAP BW: A Step-by-Step Guide”, First Edition, Pearson Education, 2003.

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
MANAGEMENT INFORMATION SYSTEM (MIS)
(OPEN ELECTIVE – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: EE832OE	**3**	**0**	**0**	**3**

Course Objective:

- To provide the basic concepts of Enterprise Resource Planning and Management of Information System.
- Explain to students why information systems are so important today for business and management;
- Evaluate the role of the major types of information systems in a business
- Assess the impact of the Internet and Internet technology on business-electronic commerce and electronic business;
- Identify the major management challenges to building and using information systems and learn how to find appropriate solutions to those challenges

Course Outcomes: The completion of the subject, the student will be able to

- Understand the usage of MIS in organizations and the constituents of the MIS
- Understand the classifications of MIS, understanding of functional MIS and the different functionalities of these MIS. This would be followed by case study on Knowledge management.
- Assess the requirement and stage in which the organization is placed. Nolan model is expected to aid such decisions
- Learn the functions and issues at each stage of system development. Further different ways in which systems can be developed are also learnt.

UNIT – I

Introduction to IS Models and Types of Information systems: – Nolan Stage Hypothesis, IS Strategic Grid, Wards Model, Earl's Multiple Methodology, Critical Success Factors, Soft Systems Methodology, Socio-Technical Systems Approach (Mumford), System Develop Life Cycle, Prototype and End User Computing, Application Packages, Outsourcing, Deciding Combination of Methods. Types of Information Systems

UNIT – II

IS Security, Control and Audit– System Vulnerability and Abuse, business value of security and control, Need for Security, Methods of minimizing risks IS Audit, ensuring system quality.

UNIT – III

Induction to ERP: Overview of ERP, MRP, MRPII and Evolution of ERP, Integrated Management Systems, Reasons for the growth of ERP, Business Modeling, Integrated Data Model, Foundations of IS in Business, Obstacles of applying IT, ERP Market- ERP Modules: Finance, Accounting Systems, Manufacturing and Production Systems, Sales and Distribution Systems, , Human Resource Systems, Plant Maintenance System, Materials Management System, Quality Management System, ERP System Options and Selection, ERP proposal Evaluation.

UNIT – IV

Benefits of ERP: Reduction of Lead Time, On-Time Shipment, Reduction in Cycle Time, Improved Resource Utilisation, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design Making Capabilities.

UNIT – V

ERP Implementation and Maintenance: Implementation Strategy Options, Features of Successful ERP Implementation, Strategies to Attain Success, User Training, Maintaining ERP & IS**.** Case Studies.

TEXT BOOKS:

1. Gordon B. Davis & Margrethe H. Olson: Management Information Systems, TMH, 2009.
2. C Laudon and Jane P. Laudon, et al: Management Information Systems, Pearson Education, 2009.
3. Alexis Leon: ERP (Demystified), 5/E, Tata McGraw-Hill, 2009.
4. C. S. V. Murthy: Management Information System, Himalaya, 2009
5. James A. Obrein: Management Information Systems, TMH, 2009
6. David L Olson: Managerial Issues of Enterprise Resource Planning Systems, McGraw Hill, International Edition-2009.
7. Rainer, Turban, Potter: Introduction to Information Systems, WILEY-India, 2009.
8. Vaman, ERP in Practice, TMH, 2009

REFERENCE BOOKS:

1. Dharminder and Sangeetha: Management Information Systems, Excel, 2009
2. Gerald V. Post, David L Anderson: Management Information Systems, Irvin McGraw Hill, 2009.
3. Monk: Concepts in ERP, Cengage, 2009
4. Olson: Managerial Issues of ERO, TMH, 2009
5. Motiwala: Enterprise Resource Planning, Pearson 2009
6. Miller: MIS—Cases, Pearson, 2009

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING
ORGANIZATIONAL BEHAVIOUR
(OPEN ELECTIVE – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: EE833OE	**3**	**0**	**0**	**3**

Course Objective:

- To provide the students with the conceptual framework and the theories underlying Organisational Behaviour.

Course Outcomes: Upon the completion of the subject, the student will be able to

- Analyse the behaviour of individuals and groups in organizations in terms of the key factors that influence organizational behaviour.
- Assess the potential effects of organizational level factors (such as structure, culture and change) on organizational behaviour.
- Critically evaluate the potential effects of important developments in the external environment (such as globalization and advances in technology) on organizational behaviour.
- Analyse organizational behavioural issues in the context of organizational behaviour theories, models and concepts.

UNIT – I

Introduction to OB - Definition, Nature and Scope –Environmental and organizational context – Impact of IT, globalization, Diversity, Ethics, culture, reward systems and organizational design on Organisational Behaviour. Cognitive Processes-I : Perception and Attribution: Nature and importance of Perception – Perceptual selectivity and organization - Social perception – Attribution Theories – Locus of control –Attribution Errors –Impression Management.

UNIT – II

Cognitive Processes-II: Personality and Attitudes - Personality as a continuum – Meaning of personality - Johari Window and Transactional Analysis - Nature and Dimension of Attitudes – Job satisfaction and organisational commitment-Motivational needs and processes- Work-Motivation Approaches Theories of Motivation- Motivation across cultures - Positive organizational behaviour: Optimism – Emotional intelligence – Self-Efficacy.

UNIT – III

Dynamics of OB-I: Communication – types - interactive communication in organizations – barriers to communication and strategies to improve the follow of communication - Decision Making: Participative decision making techniques – creativity and group decision making . Dynamics of OB –II Stress and Conflict: Meaning and types of stress –Meaning and types of

conflict - Effect of stress and intra-individual conflict - strategies to cope with stress and conflict.

UNIT – IV

Dynamics of OB –III Power and Politics: Meaning and types of power – empowerment - Groups Vs. Teams – Nature of groups –dynamics of informal groups – dysfunctions of groups and teams – teams in modern work place.

UNIT – V

Leading High performance: Job design and Goal setting for High performance- Quality of Work Life- Socio technical Design and High performance work practices - Behavioural performance management: reinforcement and punishment as principles of Learning –Process of Behavioural modification - Leadership theories - Styles, Activities and skills of Great leaders.

TEXT BOOKS:

1. Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2009
2. Mc Shane: Organizational Behaviour, 3e, TMH, 2008
3. Nelson: Organizational Behaviour, 3/e, Thomson, 2008.
4. New strom W. John& Davis Keith, Organisational Behaviour-- Human Behaviour at Work, 12/e, TMH, New Delhi, 2009.
5. Pierce and Gardner: Management and Organisational Behaviour: An Integrated perspective, Thomson, 2009.
6. Robbins, P. Stephen, Timothy A. Judge: Organisational Behaviour, 12/e, PHI/Pearson, New Delhi, 2009.
7. Pareek Udai: Behavioural Process at Work:, Oxford & IBH, New Delhi, 2009.

REFERENCE BOOKS:

1. Schermerhorn: Organizational Behaviour 9/e, Wiley, 2008.
2. Hitt: Organizational Behaviour, Wiley, 2008
3. Aswathappa: Organisational Behaviour, Himalaya, 2009
4. Mullins: Management and Organisational Behaviour, Pearson, 2008.
5. McShane, Glinow: Organisational Behaviour--Essentials, TMH, 2009.
6. Ivancevich: Organisational Behaviour and Management, 7/e, TMH, 2008.

B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING
ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
(Open Elective – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: EI511OE	**3**	**0**	**0**	**3**

Prerequisite: Nil

Course Objectives:

- It provides an understanding of various measuring systems functioning and metrics for performance analysis.
- Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
- Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes: On completion of this course student can be able to

- Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.
- Measure various physical parameters by appropriately selecting the transducers.
- Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

UNIT - I

Block Schematics of Measuring Systems: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag ;Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT - II

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

UNIT - III

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.

Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT - IV

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

UNIT - V

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

TEXT BOOKS:

1. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

REFERENCE BOOKS:

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING
INDUSTRIAL ELECTRONICS
(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: EI621OE	**3**	**0**	**0**	**3**

Pre-requisites: Basic Electrical and Electronics Engineering or Electronic Devices and Circuits.

UNIT - I

DC Amplifiers: Need for DC amplifiers, DC amplifiers - Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers - Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.

UNIT - II

Regulated Power Supplies: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques - Short Circuit, Over voltage and Thermal Protection.

Switched Mode & IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators - Current boosting .

UNIT - III

SCR and Thyristor: Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors - Classes A, B, C, D, E and F, Ratings of SCR.

UNIT - IV

Applications of SCR in Power Control: Static circuit breaker, Protection of SCR, Inverters - Classification, Single Phase inverters, Converters –single phase Half wave and Full wave.

DIAC, TRIAC and Thyristor Applications: Chopper circuits – Principle, methods and Configurations, DIAC AND TRIAC, TRIACS – Triggering modes, Firing Circuits, Commutation.

UNIT - V

Industrial Applications - I: Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators.

Electric Welding Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.

Industrial Applications - II: High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics – Generation and Applications.

TEXTBOOKS:

1. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
2. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972.

REFERENCE BOOKS:

1. Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edn., 2003.
2. Thyristors and applications – M. Rammurthy, East-West Press, 1977.3.
3. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE

B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING
SENSORS AND TRANSDUCERS
(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: EI831OE	**3**	**0**	**0**	**3**

Pre-requisites: Nil

Course Objectives: To enable the students to select and design suitable instruments to meet the requirements of industrial applications and various transducers used for the measurement of various physical quantities and the following:

- Various types of Sensors & Transducers and their working principle
- Resistive, Capacitive and Inductive transducers
- Some of the miscellaneous transducers
- Characteristics of transducers

Course Outcomes: Upon completion of this course the student shall be able to understand the working of basic sensors and transducers used in any industries.

UNIT – I

Measurements and Instrumentation of Transducers: Measurements – Basic method of measurement – Generalized scheme for measurement systems – Units and standards – Errors – Classification of errors, error analysis – Statistical methods – Sensor – Transducer – Classification of transducers – Basic requirement of transducers.

UNIT – II

Characteristics of Transducers: Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs

UNIT – III

Resistive Transducers: Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications – Torque measurement – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer

UNIT – IV

Inductive and Capacitive Transducer: Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

UNIT – V

Miscellaneous Transducers: Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Digital transducers

TEXT BOOKS:

1. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, Dhanpat Rai & Company Private Limited, 2007.
2. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 2003.

REFERENCE BOOKS:

1. Renganathan. S, "Transducer Engineering", Allied Publishers, Chennai, 2003.
2. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000.
3. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
4. Murthy. D. V. S, "Transducers and Instrumentation", Prentice Hall of India, 2001.
5. Sensor Technology Hand Book – Jon Wilson, Newne 2004.
6. Instrument Transducers – An Introduction to their Performance and design – by Herman K. P. Neubrat, Oxford University Press.

B.TECH. ELECTRONICS AND INSTRUMENTATION ENGINEERING
PC BASED INSTRUMENTATION
(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: EI832OE	**3**	**0**	**0**	**3**

Course Objective: To introduce interfacing data acquisition systems to PC and introducing PLCs with their classification, operation, and programming.

UNIT – I

Introduction to Computer Instrument Communication: Personal Computer, overview of operating System, I/O Ports, Plug-in-slots, PCI bus, Operators Interface. Computer Interfacing for Data Acquisition and Control – Interfacing Input Signals, Output system with continuous actuators. Data Acquisition and Control using Standard Cards: PC expansion systems, Plug-in Data Acquisition Boards; Transducer to Control room, Backplane bus – VXI.

UNIT – II

Programmable logic controller (PLC) basics: Definition, overview of PLC systems, input/output modules, power supplies, and isolators.

Basic PLC programming: Programming On-Off inputs/ outputs. Creating Ladder diagrams Basic PLC functions PLC Basic Functions, register basics, timer functions, counter functions.

UNIT – III

PLC intermediate and advanced functions: Arithmetic functions, number comparison functions, Skip and MCR functions, data move systems. Utilizing digital bits, sequencer functions, matrix functions. PLC Advanced functions: Analog PLC operation, networking of PLC.

UNIT – IV

Application of PLC: Controlling of Robot using PLC, PID control of continuous processes, Continuous Bottle-filling system, Batch mixing system, 3-stage air conditioning system, Automatic frequency control of Induction heating

UNIT – V

Related Topics: Alternate programming languages. Auxiliary commands and functions. PLC installation, troubleshooting, and maintenance. Field bus: Introduction, concept. HART protocol: Method of operation, structure, and applications. Smart transmitters, smart valves, and smart actuators.

TEXT BOOKS

1. Programmable Logic Controllers – Principles and Applications, John. W .Webb Ronald A Reis , Fourth edition, Prentice Hall Inc., New Jersey, 1998.
2. Computer Control of Processes – M.Chidambaram. Narosa 2003.

REFERENCES

1. PC Based Instrumentation and Control Third Edition by Mike Tooley ; Elsevier.
2. PC Interfacing and Data Acquisition Techniques for Measurement, Instrumentation, and Control. By Kevin James; Elsevier.
3. Practical Data Acquisition for Instrumentation and Control Systems by John Park and Steve Mackay.
4. Distributed Control Systems, Lukcas M.P, Van Nostrand Reinhold Co., New York, 1986.
5. 5. Programmable Logic Controllers, Second edition, Frank D. Petruzella, Mc Graw Hill, New York, 1997.
6. Programmable Logic Controllers Programming methods and applications-Prentice Hall by John R. Hackworth and Frederick D. Hackworth, Jr.

B.TECH. MECHANICAL ENGINEERING
OPTIMIZATION TECHNIQUES
(Open Elective – I)

	L	T/P/D	C
B.Tech. III Year I Sem.			
Course Code: **ME511OE**	**3**	**0/0/0**	**3**

Prerequisite: Mathematics –I & Mathematics –II

Course Objectives:

- To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
- Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project implementation.

Course Outcomes: After completion of this course, the student will be able to

- explain the need of optimization of engineering systems
- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
- apply unconstrained optimization and constrained non-linear programming and dynamic programming
- Formulate optimization problems.

UNIT – I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints.

Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT – III

Unconstrained Nonlinear Programming: One dimensional minimization methods, Classification, Fibonacci method and Quadratic interpolation method

Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method.

UNIT – IV

Constrained Nonlinear Programming: Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT – V

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOKS:

3. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
4. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

REFERENCE BOOKS:

4. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
5. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
6. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

B.TECH. MECHANICAL ENGINEERING
COMPUTER GRAPHICS
(Open Elective - I)

	L	T/P/D	C
B.Tech. III Year I Sem.			
Course Code: **ME512OE**	**3**	**0/0/0**	**3**

Course Objectives:

- To make students understand about fundamentals of Graphics to enable them to design animated scenes for virtual object creations.
- To make the student present the content graphically.

Course Outcomes:

- Students can animate scenes entertainment.
- Will be able work in computer aided design for content presentation..
- Better analogy data with pictorial representation.

UNIT - I

Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices

Output primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms.

UNIT - II

2-D Geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

UNIT - III

3-**D Object representation**: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B-spline surfaces, sweep representations, octrees BSP Trees,

3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT - IV

Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods

Illumination Models and Surface rendering Methods: Basic illumination models, polygon rendering methods

UNIT- V

Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications

TEXT BOOKS:

1. "Computer Graphics C version", Donald Hearn and M. Pauline Baker, Pearson education.
2. "Computer Graphics Second edition", Zhigand xiang, Roy Plastock, Schaum's outlines, Tata Mc Graw hill edition.

REFERENCE BOOKS:

1. "Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
2. "Procedural elements for Computer Graphics", David F Rogers, Tata Mc Graw hill, 2nd edition.
3. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
4. "Principles of Computer Graphics", Shalini, Govil-Pai, Springer.
5. "Computer Graphics", Steven Harrington, TMH
6. Computer Graphics, F. S. Hill, S. M. Kelley, PHI.
7. Computer Graphics, P. Shirley, Steve Marschner & Others, Cengage Learning.
8. Computer Graphics & Animation, M. C. Trivedi, Jaico Publishing House.
9. An Integrated Introduction to Computer Graphics and Geometric Modelling, R. Goldman, CRC Press, Taylor&Francis Group.
10. Computer Graphics, Rajesh K.Maurya, Wiley India.

B.TECH. MECHANICAL ENGINEERING
INTRODUCTION TO MECHATRONICS
(Open Elective - I)

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **ME513OE**	**3**	**0/0/0**	**3**

Pre-requisites: Basic Electronics Engineering

Course Objectives:

- To develop an ability to identify, formulate, and solve engineering problems
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes: At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.

UNIT – I

Introduction: Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

Signal Conditioning : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT – II

Precision Mechanical Systems : Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

Electronic Interface Subsystems : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC’s - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

UNIT – III

Electromechanical Drives : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

Microcontrollers Overview : 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking, Voltage measurement using ADC).

UNIT – IV

Programmable Logic Controllers : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

UNIT – V

Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson.
2. Introduction to Mechatronics / Appukuttan /Oxford

REFERENCE BOOKS:

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill
2. "Designing Intelligent Machines". open University, London.

B.TECH. MECHANICAL ENGINEERING
FUNDAMENTALS OF MECHANICAL ENGINEERING
(Open Elective - I)

	L	T/P/D	C
B.Tech. III Year I Sem.			
Course Code: **ME514OE**	**3**	**0/0/0**	**3**

Pre-Requisites: None
Course Objectives: Understanding of basic principles of Mechanical Engineering is required in various field of engineering.

Course Outcomes: After learning the course the students should be able to
- To understand the fundamentals of mechanical systems.
- To understand and appreciate significance of mechanical engineering in different Fields of engineering.

UNIT - I
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, Statements of Zeroth Law and First law.
Energy: Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydel, Solar, wind, and bio-fuels, Environmental issues like Global warming and Ozone depletion.

UNIT - II
Properties of gases: Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between Cp and Cv, Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process
Properties of Steam: Steam formation, Types of Steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables, steam calorimeters.
Steam Boilers: Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, functioning of different mountings and accessories.

UNIT - III
Heat Engines: Heat Engine cycle and Heat Engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles.
Internal Combustion Engines: Introduction, Classification, Engine details, four- stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies.

UNIT - IV
Pumps: Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming

Air Compressors: Types and operation of Reciprocating and Rotary air compressors, significance of Multistage.

Refrigeration & Air Conditioning: Refrigerant, Vapor compression refrigeration system, vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners.

UNIT - V

Couplings, Clutches and Brakes: Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc).

Transmission of Motion and Power: Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive.

Engineering Materials: Types and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer.

TEXT BOOKS:

1. Basic Mechanical Engineering / Pravin Kumar/ Pearson
2. Introduction to Engineering Materials / B.K. Agrawal/ Mc Graw Hill

REFERENCE BOOKS:

1. Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI
2. Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria

B.TECH. MECHANICAL ENGINEERING
WORLD CLASS MANUFACTURING
(Open Elective – II)

B.Tech. III Year II Sem.	L	T/P/D	C
Course Code: ME621OE	3	0/0/0	3

Pre-requisites: None

Course Objectives: To understand the concept of world class manufacturing, dynamics of material flow, OPT and Lean manufacturing.

Course Outcomes: Students should be able to compare the existing industry with WCM companies.

UNIT - I

Information Age and Global Competitiveness: The Emergence of Information Age; Competition and Business Challenge; Operating Environment; Globalization and International Business; Global Competitiveness and Manufacturing Excellence; World Class Manufacturing and Information Age Competition; Manufacturing Challenges, Problems in Manufacturing Industry.

UNIT - II

Cutting Edge Technology: Value Added Engineer in - Hall's Framework; Schonberger's Framework of WCM; Gunn's Model; Maskell's Model.

Philosophy of World Class Manufacturing: Evolution of WCM; Ohno's View on WCM; Principles and Practices; Quality in WCM; Deming's & Shingo's Approach to Quality Management; Culmination of WCM.

UNIT - III

System and Tools for World Class Manufacturing: The Integration Imperative; Overview of Systems and Tools; Information Management Tools - Product and Process Design Tools, Bar Code Systems, Kanban: A Lean Production Tool, Statistical Quality Control (SQC), Material Processing, and Handling Tools; Assessment of Manufacturing Systems and Tools.

Labor and HRD Practices in WCM: Human Resource Dimensions in WCM; Morale and Teamwork; High Employee Involvement; Cross Functional Teams; Work Study Methods; Human Integration Management.

UNIT - IV

Competitive Indian Manufacturing: Manufacturing Performance and Competitiveness - Indian Firms: Manufacturing Objectives and Strategy; Usage of Management Tools and Technologies; Manufacturing Management Practices; IT Infrastructure and Practices; Strategic Intent Framework; Breadth and Integration of IT Infrastructure.

Globalization and World Class Manufacturing: Generic Manufacturing Strategies for Information Age; Planning Methodology and Issues in Strategic Planning of WCM; Performance Measurement - PO-P System, TOPP System and Ambite System.

UNIT - V

The Future WCM: Manufacturing Strategy: Futile Search for an Elusive Link, Manufacturing Strategic Intent Classification, Translating Intent into Action.

Case Studies: Accelerated Fermentation Process – Using World Class Enzymes; Birla Cellulosic Kharach.

TEXT BOOKS:

1. World Class Manufacturing- A Strategic Perspective / BS Sahay, KBS Saxena & Ashish Kumar / Macmillan
2. Making Common Sense Common Practice – Models for Manufacturing Excellence / Ron Moore / Butter Worth Heinemann

REFERENCE BOOKS:

1. Managing Technology and Innovation for Competitive Advantage / V. K. Narayanan/ Prentice Hall
2. World Class Manufacturing - The Lesson of Simplicity / Richard J Schonberger / Free Press

B.TECH. MECHANICAL ENGINEERING
FUNDAMENTALS OF ROBOTICS
(Open Elective – II)

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
Course Code: **ME622OE**	**3**	**0/0/0**	**3**

Course Objectives: The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.

- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students to understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

Course outcomes: After this completion of this course, the student should be able to

- Understand the basic components of robots.
- Differentiate types of robots and robot grippers.
- Model forward and inverse kinematics of robot manipulators.
- Analyze forces in links and joints of a robot.
- Programme a robot to perform tasks in industrial applications.
- Design intelligent robots using sensors.

UNIT - I

Robotics-Introduction-classification with respect to geometrical configuration (Anatomy), Controlled system & chain type: Serial manipulator & Parallel Manipulator. Components of Industrial robotics-precession of movement-resolution, accuracy & repeatability-Dynamic characteristics- speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors,& Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

UNIT - II

Grippers - Mechanical Gripper-Grasping force-Engelberger-g-factors-mechanisms for actuation, Magnetic gripper , vaccume cup gripper-considerations in gripper selection & design . Industrial robots specifications. Selection based on the Application .

UNIT - III

Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, D-H transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots

UNIT - IV

Trajectory planning: Joint space scheme- Cubic polynomial fit-Obstacle avoidance in operation space-cubic polynomial fit with via point, bleding scheme. Introduction Cartesian space scheme.

Control- Interaction control, Rigid Body mechanics, Control architecture- position, path velocity, and force control systems, computed torque control, adaptive control, and Servo system for robot control.

UNIT - V

Programming of Robots and Vision System-Lead through programming methods- Teach pendent- overview of various textual programming languages like VAL etc.

Machine (robot) vision:

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Robotics / John J. Craig/ Pearson

REFERENCE BOOKS:

1. Theory of Applied Robotics /Jazar/Springer.
2. Robotics / Ghosal / Oxford

B.TECH. MECHANICAL ENGINEERING
FABRICATION PROCESSES
(Open Elective –II)

	L	T/P/D	C
B.Tech. III Year II Sem.			
Course Code: **ME623OE**	**3**	**0/0/0**	**3**

Course Objectives: Understand the philosophies of various Manufacturing process.

Course Outcomes: For given product, one should be able identify the manufacturing process.

UNIT – I

Casting: Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands.

Methods of Melting - Crucible melting and cupola operation – Defects in castings;

Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design.

UNIT – II

Welding: Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.

Inert Gas Welding - TIG Welding, MIG welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

UNIT – III

Hot working, cold working, strain hardening, recovery, recrystallisation, and grain growth.

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 requirement in the above operations.

UNIT – IV

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

UNIT – V

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. Manufacturing Technology / P.N. Rao / Mc Graw Hill
2. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson.

REFERENCE BOOKS:

1. Metal Casting / T.V Ramana Rao / New Age
2. Métal Fabrication Technology/ Mukherjee/PHI

B.TECH. MECHANICAL ENGINEERING
TOTAL QUALITY MANAGEMENT
(Open Elective - III)

B.Tech. IV Year II Sem.	L	T/P/D	C
Course Code: **ME831OE**	3	0/0/0	3

UNIT - I

Introduction, The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems.

Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT -II

Customer Focus and Satisfaction: Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.

Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing.

UNIT- III

Organizing for TQM: The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, paneto diagram, Kepner &Tregoe Methodology.

UNIT- IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

UNIT -V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOK:

1. Total Quality Management / Joel E. Ross/Taylor and Franscis Limited
2. Total Quality Management/P. N. Mukherjee/PHI

REFERENCE BOOKS:

1. Beyond TQM / Robert L.Flood
2. Statistical Quality Control / E.L. Grant.
3. Total Quality Management:A Practical Approach/H. Lal
4. Quality Management/Kanishka Bedi/Oxford University Press/2011

5. Total Engineering Quality Management/Sunil Sharma/Macmillan

B.TECH. MECHANICAL ENGINEERING

INDUSTRIAL SAFETY, HEALTH, AND ENVIRONMENTAL ENGINEERING

(Open Elective - III)

B.Tech. IV Year II Sem.	**L**	**T/P/D**	**C**
Course Code: ME832OE	**3**	**0/0/0**	**3**

Pre-requisites: None

Course Objectives:

- To provide exposure to the students about safety and health provisions related to hazardous processes as laid out in Factories act 1948.
- To familiarize students with powers of inspectorate of factories.
- To help students to learn about Environment act 1948 and rules framed under the act.
- To provide wide exposure to the students about various legislations applicable to an industrial unit.

Course Outcomes:

- To list out important legislations related to Health , Safety and Environment
- To list out requirements mentioned in factories act for the prevention of accidents. To understand the health and welfare provisions given in factories act.
- To understand the statutory requirements for an Industry on registration, license and its renewal.
- To prepare onsite and offsite emergency plan.

UNIT - I

Factories Act – 1948 : Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Telangana Factories Rules 1950 under Safety and health chapters of Factories Act 1948

UNIT II

Environment Act – 1986: General Powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board. Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.

UNIT - III

Manufacture, Storage and Import of Hazardous

Chemical Rules 1989 : Definitions – duties of authorities – responsibilities of occupier – notification of major accidents –information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets.

UNIT - IV

Other Acts and Rules : Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, workman compensation act, rules – electricity act and rules – hazardous wastes (management7 and handling) rules, 1989, with amendments in 2000- the building and other construction workers act 1996., Petroleum rules, Gas cyclinder rules-Explosives Act 1983-Pesticides Act

UNIT - V

International Acts and Standards: Occupational Safety and Health act of USA (The Williames-Steiger Act of 1970) – Helath and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI).

TEXT BOOKS:

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt. Ltd., New Delhi.
3. Industrial Safety, Health and Environment Management Systems / R. K. Jain, Sunil S. Rao / Khanna Publishers.

REFERENCE BOOKS:

1. Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt. Ltd., New Delhi.
2. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt. Ltd., New Delhi.
3. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt. Ltd., Allahabad.
4. The Mines Act 1952, Commercial Law Publishers (India) Pvt. Ltd., Allahabad.
5. The manufacture, storage, and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.

B.TECH. MECHANICAL ENGINEERING
BASICS OF THERMODYNAMICS
(Open Elective - III)

	L	T/P/D	C
B.Tech. IV Year II Sem.			
Course Code: **ME833OE**	**3**	**0/0/0**	**3**

Pre-requisite: Engineering Chemistry and Physics

Course Objective: To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications

Course Outcomes: At the end of the course, the student should be able to:

- Understand and differentiate between different thermodynamic systems and processes
- Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes
- Understand and analyze the Thermodynamic cycles

UNIT – I

Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle, Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility

UNIT - II

Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

UNIT – III

First and Second Laws of Thermodynamics: First Law: Cycle and Process, Specific Heats (cp and cv), Heat interactions in a Closed System for various processes, Limitations of First Law, Concept of Heat Engine (H.E.) and Reversed H.E. (Heat Pump and Refrigerator), Efficiency/COP, Second Law: Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, Statement of Clausius Inequality, Property of Entropy, T-S and P-V Diagrams

UNIT - IV

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const.

Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, , Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation ,Psychrometric chart.

UNIT - V

Power Cycles: Otto, Diesel cycles - Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis

Refrigeration Cycles: Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS:

1. Basic Engineering Thermodynamics / PK Nag / Mc Graw Hill
2. Engineering Thermodynamics / chattopadhyay/ Oxford

REFERENCE BOOKS:

1. Thermodynamics for Engineers / Kenneth A. Kroos , Merle C. Potter/ Cengage
2. Thermodynamics /G.C. Gupta /Pearson

B.TECH. MECHANICAL ENGINEERING
RELIABILITY ENGINEERING
(Open Elective - III)

B.Tech. IV Year II Sem.	L	T/P/D	C
Course Code: **ME834OE/AM852PE/EI862PE**	**3**	**0/0/0**	**3**

Prerequisite: Mathematics III

Course Objectives:

- To introduce the basic concepts of reliability, various models of reliability
- To analyze reliability of various systems
- To introduce techniques of frequency and duration for reliability evaluation of repairable systems.

Course Outcomes: After completion of this course, the student will be able to

- model various systems applying reliability networks
- evaluate the reliability of simple and complex systems
- estimate the limiting state probabilities of repairable systems
- apply various mathematical models for evaluating reliability of irrepairable systems

UNIT – I

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.

Definition of Reliability: Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time Between Failures.

UNIT – II

Network Modeling and Evaluation Of Simple Systems: Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems- Series-Parallel systems- Partially redundant systems- Examples.

Network Modeling and Evaluation of Complex systems: Conditional probability method- tie set, Cutset approach- Event tree and reduced event tree methods- Relationships between tie and cutsets- Examples.

UNIT – III

Time Dependent Probability: Basic concepts- Reliability function f(t). F(t), R(t) and h(t) - Relationship between these functions.

Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

UNIT – IV

Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Examples

Continuous Markov Processes: Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems

UNIT – V

Frequency and Duration Techniques: Frequency and duration concepts, application to multi state problems, Frequency balance approach.

Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press, 1983.
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited, 2002.

REFERENCE BOOK:

1. K. K. Agarwal, Reliability Engineering-Kluwer Academic Publishers, 1993**.**

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

FABRICATION PROCESSES

(Open Elective - I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: NT511OE	**3**	**0**	**0**	**3**

Course Objectives: Understand the philosophies of various Manufacturing process.

Course Outcomes: For given product, one should be able identify the manufacturing process.

UNIT – I

Casting: Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands.

Methods of Melting - Crucible melting and cupola operation – Defects in castings;

Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design.

UNIT – II

Welding: Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.

Inert Gas Welding - TIG Welding, MIG welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

UNIT – III

Hot working, cold working, strain hardening, recovery, recrystallisation, and grain growth.

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 requirement in the above operations.

UNIT – IV

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

UNIT – V

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. Manufacturing Technology / P.N. Rao / Mc Graw Hill
2. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson.

REFERENCE BOOKS:

1. Metal Casting / T. V Ramana Rao / New Age
2. Métal Fabrication Technology/ Mukherjee/PHI

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

NON DESTRUCTIVE TESTING METHODS

(Open Elective - I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: NT512OE	**3**	**0**	**0**	**3**

Course overview: The aim is to introduce students the overview of the non destructive testing methods of materials. The course covers NDE, Ultrasonic, MPI testing of metal parts. It gives an idea about selection of the testing criteria. It briefly describe the thermo-graph and radio graph methods of testing and provide selection properties for different tests.

Course Objectives: This course has the basic idea of the properties of steal and ferrous metals. The objectives aim to:

- Identify the basic methods of testing.
- Understand the concept of non destructive testing.
- Describe the various types of NDT tests carried out on components.
- Describe ultrasonic method of testing the materials.
- Analyze the different types of test carried out on components and surfaces.
- Understand the properties of materials suitable for NDT test.
- Understand the radiography uses in engineering.

Course Outcomes: At the end of the course the students are able to:

- Identify the requirements of testing criteria as per material composition.
- Understand the theory of non destructive testing methods is used.
- Determine the type of requirement of non destructive test.
- Distinguish between the various NDT test as Ultrasonic and Eddy current methods.
- Understand the properties of radiation used in engineering.
- Describe the various types of non destructive test used to determine the surface cracks.

UNIT - I

Overview of NDT - NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, various physical characteristics of materials and their applications in NDT, Visual inspection.

UNIT - II

Surface NDE Methods: Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection

materials Magnetization methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

UNIT - III

Thermography and Eddy Current Testing - Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT - IV

Ultrasonic Testing and Acoustic Emission - Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique IV Principle, AE parameters, Applications

UNIT - V

Radiography - Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films – graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

TEXT BOOKS:

1. Baldev Raj, T. Jayakumar, M. Thavasimuthu, Practical Non-Destructive Testing¡¨, Narosa Publishing House, 2009.
2. Ravi Prakash, Non-Destructive Testing Techniques¨, 1st revised edition, New Age International Publishers, 2010

REFERENCES:

1. ASM Metals Handbook, ¨Non-Destructive Evaluation and Quality Control¨, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005
3. Charles, J. Hellier, Handbook of Non-destructive evaluation”, McGraw Hill, New York 2001.

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

FUNDAMENTALS OF ENGINEERING MATERIALS

(Open Elective - I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: NT513OE	**3**	**0**	**0**	**3**

Course Overview:

The aim is to introduce students the overview of the properties of materials used in engineering manufacturing process. The course covers basic concept of ferrous, non-ferrous metals and its alloys. It emphasizes on transformation of iron at various temperatures. It briefly describes the heat treatment given to iron and its alloys. It gives the general overview idea of composite materials.

Course Objectives: This course has the basic idea of the properties of steal and ferrous metals. The objectives aim to:

- Identify the basic crystalline structure of steal.
- Understand the concept of TTT.
- Describe the various heat treatment methods to obtain the desired properties.
- Describe the composition of carbon contents in steel.
- Analyze the different forms of iron obtained during heating of steel.
- Understand the properties of non-ferrous alloys.
- Understand requirement.

Course Outcomes: At the end of the course the students are able to:

- This subject gives student a technical knowledge about behavior of metals.
- Identify the crystalline structure of steel.
- Understand the theory of time temperature and transformation.
- Determination of different uses of heat treatment in steel.
- Distinguish between the various forms of steel.
- Understand the properties of non-ferrous alloys.
- Describe the various uses of composite materials.

UNIT – I

Structure of Metals: Crystallography, Miller's 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: Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

UNIT – III

Steels: Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe3C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening and Tempering of steels, Hardenability. Alloy steels.

UNIT – IV

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 copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.

UNIT – V

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. Material Science and Metallurgy/ Kodgire
2. Essentials of Materials Science and engineering / Donald R. Askeland / Thomson.

REFERENCE BOOKS:

1. Introduction to Physical Metallurgy / Sidney H. Avner.
2. Materials Science and engineering / William and callister.
3. Elements of Material science / V. Rahghavan

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

INTRODUCTION TO MATERIALS HANDLING

(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: NT621OE	**3**	**0**	**0**	**3**

Course Overview

Course covers a systems approach to managing activities associated with traffic, transportation, inventory management, warehousing, packaging, order processing, and materials handling. This course is designed to give students a comprehensive understanding of the issues involved in the design of an industrial production system. It will cover the problems in plant location, product analysis, process design, equipment selection, materials handling, and plant layout.

Course Objectives:

- To develop competency for system visualization and design.
- To enable student to design cylinders and pressure vessels and to use IS code.
- To enable student select materials and to design internal engine components.
- To introduce student to optimum design and use optimization methods to design mechanical components.
- To enable student to design machine tool gearbox.
- To enable student to design material handling systems.
- Ability to apply the statistical considerations in design and analyze the defects and failure modes in

Course Outcomes:

- Demonstrate ability to successfully complete Fork Lift Certification to safely and effectively operate in the manufacturing environment.
- Demonstrate proficiency in supply chain operations, utilizing appropriate methods to plan and implement processes necessary for the purchase and conveyance of goods in a timely and cost-effective manner
- It explains about the different types of material handling, advantages and disadvantages. It also suggests the selection procedure for the material handling along with its specifications.
- Need for Material handling also explained with different techniques like Automated Material handling Design Program, Computerized material handling Planning will be dealt.
- The Material handling is explained with models, selection procedure of material handling is depending on different function oriented systems. This also related with plant layout by which the minimization of the handling charges will come down.

- The ergonomics related to material handling equipment about design and miscellaneous equipments.

UNIT – I

Types of intraplant transporting facility, principal groups of material handling equipments, choice of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments.

UNIT – II

Flexible hoisting appliances like ropes and chains, welded load chains, roller chains, selection of chains hemp rope and steel wire rope, selection of ropes, fastening of hain sand ropes , different types of load suspension appliances, fixed and movable pulleys, different types of pulley systems, multiple pulley systems . Chain and rope sheaves and sprockets.

UNIT – III

Load handling attachments, standard forged hook, hook weights, hook bearings, cross piece and casing of hook, crane grab for unit and piece loads, carrier beams and clamps, load platforms and side dump buckets, electric lifting magnets, grabbing attachments for loose materials, crane attachments for handling liquid materials.

UNIT – IV

Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thruster operated, controller brakes, shoe brakes, thermal calculations of shoe brakes and life of linings, safety handles, load operated constant force and variable force brakes general theory of band brakes, its types and construction.

UNIT – V

Different drives of hosting gears like individual and common motor drive for several mechanisms, traveling gear, traveling mechanisms for moving trolleys and cranes on runway rails, mechanisms for trackless, rubber-tyred and crawler cranes motor propelled trolley hoists and trolleys, rails and traveling wheels, slewing, jib and luffing gears. Operation of hoisting gear during transient motion, selecting the motor rating and determining braking torque for hoisting mechanisms, drive efficiency calculations, selecting the motor rating and determining braking torque for traveling mechanisms, slewing mechanisms, jib and luffing mechanisms. (Elementary treatment is expected)

TEXT BOOKS:

1. Materials Handling Equipment – N. Rudenko , Envee Publishers, New Delhi
2. Materials Handling Equipment – M.P. Alexandrov. Mie publications, Moscow

REFERENCE BOOKS:

1. Aspects of Material handling - Arora

2. Introduction to Material Handling- Ray
3. Plant Layout and Material Handling- Chowdary RB

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

NON-CONVENTIONAL ENERGY SOURCES

(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: NT622OE	3	0	0	3

Course Overview:

Non Conventional resources include solar energy, wind, falling water, the heat of the earth (geothermal), plant materials (biomass), waves, ocean currents, temperature differences in the oceans and the energy of the tides. Non Conventional energy technologies produce power, heat or mechanical energy by converting those resources either to electricity orto motive power. The policy maker concerned with development of the national grid system will focus on those resources that have established themselves commercially and are cost effective for on grid applications. Such commercial technologies include hydroelectric power, solar energy, fuels derived from biomass, wind energy and geothermal energy. Wave, ocean current, ocean thermal and other technologies that are in the research or early commercial stage, as well as non-electric Non Conventional energy technologies, such as solar water heaters and geothermal heat pumps, are also based on Non Conventional resources, but outside the scope of this Manual.

Course Objectives:

- Graduates will demonstrate the ability to use basic knowledge in mathematics, science and engineering and apply them to solve problems specific to mechanical engineering (Fundamental engineering analysis skills).
- Graduates will demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results (Information retrieval skills).
- Graduates should be capable of self-education and clearly understand the value of life-long learning (Continuing education awareness).
- Graduates will develop an open mind and have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues (Social awareness).
- Graduate will be able to design a system to meet desired needs within environmental, economic, political, ethical health and safety, manufacturability and management knowledge and techniques to estimate time, resources to complete project (Practical engineering analysis skills).

Course Outcomes:

- Introduction to Renewable Energy Sources, Principles of Solar Radiation, Different Methods of Solar Energy Storage and its Applications, Concepts of Solar Ponds, Solar Distillation and Photo Voltaic Energy Conversion

- Introduction to Flat Plate and Concentrating Collectors ,Classification of Concentrating Collectors
- Introduction to Wind Energy, Horizontal and Vertical Access Wind Mills, Bio-Conversion
- Types of Bio-Gas Digesters and Utilization for Cooking Geothermal Energy Resources
- Types of Wells and Methods of Harnessing the Energy, Ocean Energy and Setting of OTEC Plants
- Tidal and Wave Energy and Mini Hydel Power Plant, Need and Principles of Direct Energy Conversion
- Concepts of Thermo-Electric Generators and MHD Generators

UNIT - I

Statistics on conventional energy sources and supply in developing countries, Definition-Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES. Classification of NCES - Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources.

UNIT - II

Solar Energy-Energy available form Sun, Solar radiation data, Solar energy conversion into heat, Flat plate and Concentrating collectors, Mathematical analysis of Flat plate collectors and collector efficiency, Principle of Natural and Forced convection, Solar engines-Stirling, Brayton engines, Photovoltaic, p-n junction, solar cells, PV systems, Stand-alone, Grid connected solar power satellite.

UNIT - II

Wind energy conversion, General formula -Lift and Drag- Basis of wind energy conversion - Effect of density, frequency variances, angle of attack, and wind speed. Windmill rotors-Horizontal axis and vertical axis rotors. Determination of torque coefficient, Induction type generators- working principle.

UNIT - IV

Nature of Geothermal sources, Definition and classification of resources, Utilization for electric generation and direct heating, Well Head power generating units, Basic features-Atmospheric exhaust and condensing, exhaust types of conventional steam turbines.

Pyrolysis of Biomass to produce solid, liquid and gaseous fuels, Biomass gasification, Constructional details of gasifier, usage of biogas for chulhas, various types of chulhas for rural energy needs.

UNIT - V

Wave, Tidal and OTEC energy- Difference between tidal and wave power generation, Principles of tidal and wave power generation, OTEC power plants, Operational of small

cycle experimental facility, Design of 5 Mw OTEC pro-commercial plant, Economics of OTEC, Environmental impacts of OTEC. Status of multiple product OTEC systems.

TEXT BOOKS:

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi, 2003
2. K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi, 2003.

REFERENCE BOOKS:

1. Ramesh R & Kumar K U, *Renewable Energy Technologies,* Narosa Publishing House, New Delhi, 2004
2. Wakil MM, *Power Plant Technology,* Mc Graw Hill Book Co, New Delhi, 2004.
3. Non - Conventional Energy Sources. Rai

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

ROBOTICS

(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: NT623OE	**3**	**0**	**0**	**3**

Pre-requisites: Basic principles of Kinematics and mechanics

Course Objectives: The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.

- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students to understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

Course Outcomes: At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors.

UNIT – I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications.

Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

UNIT – II

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulation.

UNIT – III

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line motion.

UNIT IV

Robot actuators and Feedback components:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors.

UNIT V

Robot Application in Manufacturing:

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Industrial Robotics / Ramachandran Nagarajan / Pearson

REFERENCE BOOKS:

1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley
2. Robot Analysis and control / Asada , Slotine / Wiley Inter-Science

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

CONCEPTS OF NANO SCIENCE AND TECHNOLOGY

(Open Elective - III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: NT831OE	**3**	**0**	**0**	**3**

Course Objectives:

- Beginners will be able to acquaint themselves with the excited subject though they are novice, whereas advanced learners will equip themselves to solve the complicated issues further.
- To know the importance of the synthesis method addressed in the material properties and give practical experience of nanomaterials synthesis/properties and characterization; investigations into the various factors influence the properties of nanomaterials, optimizing the procedures, and implementations to the new designs
- To provide a sound understanding of the various concepts involved in fabrication of device architectures' and able to evaluate them in advance

Course Outcome: The intended course covers the whole spectrum of nanomaterials ranging from introduction, classification, synthesis, properties, and characterization tools of nanophase materials to application including some new developments in various aspects.

UNIT - I

Introduction to Nano: Importance, Definition and scope, Nano size, challenges, applications. Electrons**,** Other Materials**,** Nano magnetism as a case study; Fundamental terms (Physics & Chemistry) in nano-science and technology; Feynman's perspective; Scaling laws pertaining to mechanics, optics, electromagnetism; Importance of Quantum mechanics, statistical mechanics and chemical kinetics in nano-science and technology;

UNIT - II

Classification of nano materials: Scientific basis for top-down and bottom-up approaches to synthesize Nanomaterials; How to characterize Nanomaterials?

UNIT - III

Tools for Nanoscience and Technology: Tools for measuring properties of Nanostructures, Tools to Make Nanostructures. Nano scale Bio-structures, modelling

UNIT - IV

Nano-Biotechnology: Bio-molecules; Biosensors; Nanomaterials in drug delivery; Working in clean room environments; Safety and related aspects of Nanomaterials;

UNIT – V

Carbon Nanomaterials and Applications: Carbon Nano structures and types of Carbon Nano tubes, growth mechanisms of carbon nanotubes. Carbon clusters and Fullerenes, Lithium & Hydrogen adsorption & storages, Fuel cell applications and energy storage, Chemical Sensors applications of CNTs

TEXT BOOKS AND REFERENCES:

1. Textbook of Nanoscience and Nanotechnology – B. S. Murthy, P. Shankar, Baldev Raj, B. B. Rath and James Murday, University Press-IIM Series in Metallurgy and Materials Science.
2. A Textbook of Nanoscience and Nanotechnology – T. Pradeep, Tata McGraw Hill edition.
3. Nanotechnology Fundamentals and Applications- by Manasi Karkare I. K International
4. Nanoscience and Nanotechnology in engineering – by Vijay K Varadan A Sivathanu pillai Word scientific
5. Nanotechnology Applications To Telecommunications And Networking By Daniel Minoli, Wiley Interscience
6. Nanotechnology Principles and Applications by Sulabha Kulkarni

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

SYNTHESIS OF NANOMATERIALS

(Open Elective - III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: NT832OE	**3**	**0**	**0**	**3**

Course Objectives:

- To provide knowledge about top-down and bottom-up approaches for the synthesis of nanomaterials.
- To enhance the various nanosynthesis techniques and to identify and solve problems
- To design and conduct experiments relevant to nanochemistry, as well as to analyze the results.
- To improve usage of synthesis methods for modern technology

Course Outcome: To provide abundant knowledge on various synthesis methods of nanomaterials.

UNIT - I

Introduction, Bottom-up approach: Sol-gel method, emulsion and Top-down: ball milling approach with examples.

UNIT - II

Physical methods: Inert gas condensation, Arc discharge, plasma synthesis, electric explosion of wires, molecular beam epitaxy, Physical Vapour Deposition, thermal evaporation, lithography and sputtering.

UNIT - III

Chemical methods: Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis, co-precipitation method. Semiconductor nanocrystals by arrested precipitation, sonochemical routes

UNIT - IV

Biological methods – use of bacteria, fungi, actinomycetes for nano-particle synthesis nano-particles Solvated metal atom dispersion, Template based synthesis of nanomaterials.

UNIT - V

Thermolysis route - spray pyrolysis, solvothermal and hydrothermal routes, solution combustion synthesis, Chemical vapor deposition

TEXTBOOKS:

1. Textbook of Nanoscience and Nanotechnology – B. S. Murthy, P. Shankar, Baldev Raj, B. B .Rath and James Murday, University Press-IIM Series in Metallurgy and Materials Science.
2. A Textbook of Nanoscience and Nanotechnology – T. Pradeep, Tata McGraw Hill edition.
3. Nanostructures and Nanomaterials by Guozhong Cao
4. Inorganic Materials Synthesis and Fabrication by J.N. Lalena, D.A. Cleary, E.E. Carpenter, N.F. Dean, John Wiley & Sons Inc.
5. Introduction to Nano Technology by Charles P. Poole Jr and Frank J. Owens. Wiley India Pvt Ltd.
6. The Chemistry of nanomaterials: Synthesis, Properties and Applications, Vol-I by C.N.R. Rao, A. Muller and A.K. Cheetham
7. The Physics of Micro/Nano- Fabrication by Ivor Brodie and Julius J.Muray

REFERENCE BOOKS:

1. Encyclopedia of Nanotechnology by M. Balakrishna Rao and K. Krishna Reddy, Vol I to X, Campus books.
2. Encyclopedia of Nanotechnology by H.S. Nalwa
3. Nano: The Essentials – Understanding Nano Science and Nanotechnology – by T. Pradeep, Tata McGraw Hill

B.TECH. MECHANICAL ENGINEERING (MATERIAL SCIENCE AND NANOTECHNOLOGY)

CHARACTERIZATION OF NANOMATERIALS

(Open Elective - III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: NT833OE	**3**	**0**	**0**	**3**

Course Objectives:

- To develop ability to understand modern characterization techniques especially utilized to probe in nanoscopic regime
- To elucidate on application of standard spectroscopy, microscopy techniques for element analysis, structure analysis, depth profiling, topography imaging, as well as surface and interface analysis
- To provide overview of principles underlying the characterization methods and basic theory for analysis of the data obtained from the instrument
- The objective of this course is to make the students understand the principles underlying various spectroscopies and instrumentations specific to nanomaterials

UNIT - I

Fundamentals of Electron Microscopy: Advantages of Electron Microscope over Optical Microscope (Magnification, Resolution, Depth of field). Theory and principle of Electron Microscope, Electron sources, Electron lenses (Electrostatic and Electromagnetic).

UNIT - II

Scanning Electron Microscopy: SEM: Theory of operation, Specimen-Beam interactions Importance of beam spot size, Machine variables, Scanning Electron Microscope (SEM). **Specimen Preparation in SEM**: Special methods for various sample types – Biological sample preparation, Applications of SEM

UNIT - III

Transmission Electron Microscopy: TEM: Theory of operation, Modes of operation, Transmission Electron Microscope (TEM),Bright field Imaging, Electron diffraction, Dark field imaging, High Resolution TEM (HRTEM), Applications of TEM.

UNIT - IV

Atomic Force Microscopy: AFM: Basic concepts – Interactive forces, Principle and instrumentation, Force curves and force measurements, Modes of imaging: Tapping, contact and non-contact, Probes, Tip functionalization,

UNIT - V

X-Ray Diffraction and Spectroscopic methods:

X-ray diffraction–Powder method, Single crystal diffraction technique -Determination of crystal strucures – Nanostructural analysis – Profile analysis (peak broadening and micro strain) – Crystallite size analysis using Scherer formula and Williamson – Hall equation. UV Spectroscopy, IR Spectroscopy and Raman Spectroscopy

TEXT BOOKS:

1. Nanotechnology: Principles and Practices – Sulabha K. Kulkarni – Capital Publishing Company
2. 2. Nano: The Essentials – Understanding Nanoscience and Nanotechnology by T. Pradeep. Tata McGraw Hill
3. 3. Introduction to Nano Technology by Charles. P. Poole Jr and Frank J. Owens, Wiley India Pvt Ltd.
4. A practical approach to X-Ray diffraction analysis by C. Suryanarayana

REFERENCES:

1. Haynes. R, Woodruff. D. P. and Talchar, T.A., optical Microscopy of Materials Cambridge University press, 1986.
2. Flegler, S.L., Heckman, J.W. and Klomparens, K.L., scanning and Transmission Electron Microscopy: A Introduction WH Freeman & Co, 1993.
3. Paul E. West, introduction to Atomic Force Microscopy Theory Practice Applications
4. Julian Chen N, C., introduction to Scanning Tunneling Microscopy, Oxford University Press, Inc., 1993.
5. Magonov, S.M., and Whangbo, M-H., surface Analysis with STM and AFM: Experimental and Theoretical Aspects of Image Analysis VCH Publishers, Inc., New York 1996.
6. Goldstein, J., Newbury, D.E., Joy, D.C., and Lym, C.E., scanning Electron Microscopy and X-ray Microanalysis, 2003.

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)
ANALOG AND DIGITAL IC APPLICATIONS
(OPEN ELECTIVE – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: MT511OE	**3**	**0**	**0**	**3**

UNIT - I

Integrated Circuits : Classification, chip size and circuit complexity, basic information of Op amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

OP-AMP Applications: Basic application of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, sample & hold circuits, multipliers and dividers, Differentiators and Integrators, Comparators.

UNIT - II

Schmitt trigger, Multivibrators, introduction to voltage regulators, features of 723.

Active Filters & Oscillators: Introduction, 1st order LPF, HPF filters. Band pass, Band reject, and all pass filters. Oscillator types and principle of operation – RC, Wien, and quadrature type, waveform generators – triangular, saw tooth, square wave and VCO.

UNIT - III

Timers & Phase Locked Loops: Introduction to 555 timer, functional diagram, monostable and astable operations, and applications, Schmitt Trigger. PLL - introduction, block schematic, principles, and description of individual blocks of 565.

D-A and A- D Converters : Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC. DAC and ADC specifications.

UNIT - IV

Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate- Analysis& characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, CMOS transmission gate, IC interfacing- TTL driving CMOS & CMOS driving TTL.

Design using TTL-74XX & CMOS 40XX series, code converters, decoders, Demultiplexers, decoders, & drives for LED & LCD display. Encoder, priority Encoder, multiplexers, & their applications, priority generators/checker circuits. Digital arithmetic circuits-parallel binary adder/subtractor circuits using 2’s, Complement system. Digital comparator circuits.

UNIT - V

Sequential Circuits: Flip-flops & their conversions. Design of synchronous counters. Decade counter, shift registers, & applications, familiarities with commonly available 74XX & CMOS 40XX series of IC counters.

Memories: ROM architecture, types, & applications, RAM architecture, Static & Dynamic RAMs, synchronous DRAMs.

TEXT BOOKS:

1. Linear Integrated Circuits –D. Roy Choudhury, New Age International (p) Ltd, 2nd Ed., 2003.
2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 1987.

REFERENCES:

1. Operational Amplifiers & Linear Integrated Circuits – R.F. Coughlin & Fredrick F. Driscoll, PHI, 1977.
2. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications –Denton J. Daibey, TMH.
3. Design with Operational Amplifiers & Analog Integrated Circuits-Sergio Franco, McGraw Hill, 3rd Ed., 2002.
4. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005.

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)
INTELLECTUAL PROPERTY RIGHTS
(Open Elective – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: MT512OE	**3**	**0**	**0**	**3**

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 trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights, and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata Mc Graw Hill Publishing company ltd.,

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)
COMPUTER ORGANIZATION
(Open Elective – I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: MT513OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand basic components of computers.
- To understand the architecture of 8086 processor.
- To understand the instruction sets, instruction formats and various addressing modes of 8086.
- To understand the representation of data at the machine level and how computations are performed at machine level.
- To understand the memory organization and I/O organization.
- To understand the parallelism both in terms of single and multiple processors.

Course Outcomes:

- Able to understand the basic components and the design of CPU, ALU and Contr**ol** Unit.
- Ability to understand memory hierarchy and its impact on computer cost/performance.
- Ability to understand the advantage of instruction level parallelism and pipelining for high performance Processor design.
- Ability to understand the instruction set, instruction formats and addressing modes of 8086.
- Ability to write assembly language programs to solve problems.

UNIT - I

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Basic Computer Organization and Design: Instruction codes, Computer Registers, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, Complete Computer Description.

Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

UNIT - II

Central Processing Unit: The 8086 Processor Architecture, Register organization, Physical memory organization, General Bus Operation, I/O Addressing Capability, Special Processor Activities, Minimum and Maximum mode system and timings.

8086 Instruction Set and Assembler Directives-Machine language instruction formats, Addressing modes, Instruction set of 8086, Assembler directives and operators.

UNIT - III

Assembly Language Programming with 8086- Machine level programs, Machine coding the programs, Programming with an assembler, Assembly Language example programs.

Stack structure of 8086, Interrupts and Interrupt service routines, Interrupt cycle of 8086, Interrupt programming, Passing parameters to procedures, Macros, Timings and Delays.

UNIT - IV

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating - point Arithmetic operations.

Input-Output Organization: Peripheral Devices**,** Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input –Output Processor (IOP),Intel 8089 IOP.

UNIT - V

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Inter processor arbitration, Inter processor communication, and synchronization.

TEXT BOOKS:

1. Computer System Architecture, M. Moris Mano, Third Edition, Pearson. **(UNITS- I , IV , V)**
2. Advanced Microprocessors and Peripherals, K M Bhurchandi, A.K Ray ,3rd edition, McGraw Hill India Education Private Ltd. **(UNITS - II, III).**

REFERENCES:

1. Microprocessors and Interfacing, D V Hall, SSSP Rao, 3rd edition, McGraw Hill India Education Private Ltd.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002
3. Computer Organization and Architecture, William Stallings, 9th Edition, Pearson.
4. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)
DATA STRUCTURES
(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: EM614PE/MT621OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the basic concepts such as Abstract Data Types, Linear, and Non Linear Data structures.
- To understand the notations used to analyze the Performance of algorithms.
- To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
- To choose the appropriate data structure for a specified application.
- To understand and analyze various searching and sorting algorithms.
- To write programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables, search trees.

Course Outcomes:

- Learn how to use data structure concepts for realistic problems.
- Ability to identify appropriate data structure for solving computing problems in respective language.
- Ability to solve problems independently and think critically.

UNIT - I

Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega, and Theta notations, Introduction to Linear and Non Linear data structures.

Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations-Insertion, Deletion.

Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

UNIT - II

Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition and operations ,array and linked Implementations in C, Circular queues-Insertion and deletion operations, Deque (Double ended queue)ADT, array and linked implementations in C.

UNIT - III

Trees – Terminology, Representation of Trees, Binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals, threaded binary trees, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

Graphs – Introduction, Definition, Terminology, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph traversals - DFS and BFS.

UNIT - IV

Searching - Linear Search, Binary Search, Static Hashing-Introduction, hash tables, hash functions, Overflow Handling. Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Comparison of Sorting methods.

UNIT - V

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees-Definition and Examples, Insertion into an AVL Tree ,B-Trees, Definition, B-Tree of order m, operations-Insertion and Searching, Introduction to Red-Black and Splay Trees(Elementary treatment-only Definitions and Examples), Comparison of Search Trees.

Pattern matching algorithm- The Knuth-Morris-Pratt algorithm, Tries (examples only).

TEXT BOOKS:

1. Fundamentals of Data structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson-Freed, Universities Press.
2. Data structures A Programming Approach with C, D. S. Kushwaha and A.K. Misra, PHI.

REFERENCE BOOKS:

1. Data structures: A Pseudo code Approach with C, 2nd edition, R. F. Gilberg And B. A. Forouzan, Cengage Learning.
2. Data structures and Algorithm Analysis in C, 2nd edition, M. A. Weiss, Pearson.
3. Data Structures using C, A.M. Tanenbaum, Y. Langsam, M. J. Augenstein, Pearson.
4. Data structures and Program Design in C, 2nd edition, R. Kruse, C. L. Tondo and B. Leung, Pearson.
5. Data Structures and Algorithms made easy in JAVA, 2nd Edition, Narsimha Karumanchi, Career Monk Publications.
6. Data Structures using C, R. Thareja, Oxford University Press.
7. Data Structures, S. Lipscutz, Schaum's Outlines, TMH.
8. Data structures using C, A. K. Sharma, 2nd edition, Pearson..
9. Data Structures using C & C++, R. Shukla, Wiley India.
10. Classic Data Structures, D. Samanta, 2nd edition, PHI.
11. Advanced Data structures, Peter Brass, Cambridge.

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)

ARTIFICIAL NEURAL NETWORKS

(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: MT622OE	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.

Course Outcomes: By completing this course the student will be able to:

- Create different neural networks of various architectures both feed forward and feed backward.
- Perform the training of neural networks using various learning rules.
- Perform the testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.

UNIT - I

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT - II

Single Layer Perceptron: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT - III

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues, and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT - IV

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT - V

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm

Hopfield Models – Hopfield Models, Computer Experiment

TEXT BOOKS:

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

REFERENCE BOOKS:

1. Artificial Neural Networks - B. Yegnanarayana Prentice Hall of India P Ltd 2005
2. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)
INDUSTRIAL MANAGEMENT
(Open Elective – II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: MT623OE	**3**	**0**	**0**	**3**

UNIT - I

Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

UNIT - II

Designing Organizational Structures: Departmentation and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT - III

Operations Management: Objectives- product design process- Process selection-Types of production system (Job, batch and Mass Production),-Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts-Design of product layout- Line balancing(RPW method)

Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

UNIT - IV

Work Study: Introduction – definition – objectives – steps in work study – Method study – definition – objectives – steps of method study. Work Measurement – purpose – types of study – stop watch methods – steps – key rating – allowances – standard time calculations – work sampling.

Statistical Quality Control: variables-attributes, Shewart control charts for variables- $\overline{X}$ chart, R chart, - Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT - V

Job Evaluation: methods of job evaluation – simple routing objective systems – classification method – factor comparison method – point method – benefits of job evaluation and limitations.

Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

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 & Sons Work Study by ILO
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 / Ravi Shankar/ Galgotia

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)

RENEWABLE ENERGY SOURCES

(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: MT831OE/ME853PE	**3**	**0**	**0**	**3**

Course Objectives:

- To explain the concepts of Non-renewable and renewable energy systems
- To outline utilization of renewable energy sources for both domestic and industrial applications
- To analyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

Course Outcomes:

- Understanding of renewable energy sources
- Knowledge of working principle of various energy systems
- Capability to carry out basic design of renewable energy systems

UNIT-I

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO_2 reduction potential of renewable energy- concept of Hybrid systems.

UNIT-II

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT-III

Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

UNIT-IV

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

UNIT-V

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

1. **Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.
2. **Geothermal Energy**: Geothermal power plants, various types, hot springs and steam ejection.

REFERENCE BOOKS:

1. Non-Conventional Energy Sources by G.D Rai
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
3. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)
PRODUCTION PLANNING AND CONTROL
(Open Elective – III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: MT832OE/ME854PE	**3**	**0**	**0**	**3**

Pre-requisites: Management Science & Productivity.

Course Objectives: Understand the importance of Production planning & control. Learning way of carrying out various functions it so as to produce right product, right quantity at right time with minimum cost.

Course Outcomes: At the end of the course, the student will be able to, Understand production systems and their characteristics. Evaluate MRP and JIT systems against traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.

UNIT – I

Introduction: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

Forecasting – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques. Measures of forecasting errors.

UNIT – II

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems - Basic Treatment only. **Aggregate planning –** Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

UNIT – III

Line Balancing: Terminology, Methods of Line Balancing, RPW method, Largest Candidate method and Heuristic method.

Routing – Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

UNIT – IV

Scheduling –Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling **–** job shop scheduling, line of balance (LOB) – objectives - steps involved.

UNIT – V

Dispatching: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

Follow up: definition – types of follow up – expediting – definition – expediting procedures- Applications of computers in planning and control.

TEXT BOOKS:

1. Operations management – Heizer- Pearson.
2. Production and Operations Management / Ajay K Garg / Mc Graw Hill.

REFERENCE BOOKS:

1. Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.
2. Production Planning and Control- Jain & Jain – Khanna publications

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)
ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES
(Open Elective – III)

B.Tech. IV Year II Sem.	**L**	**T**	**P**	**C**
Course Code: CE833OE	**3**	**0**	**0**	**3**

Course Objective: The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

Course Outcome: It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

Unit – 1: Entrepreneurial Perspectives:
Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

Unit – 2: New Venture Creation:
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

Unit – 3: Management of MSMEs and Sick Enterprises
Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

Units – 4: Managing Marketing and Growth of Enterprises:
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

Units – 5: Strategic perspectives in Entrepreneurship:
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

TEXT BOOKS:

1. Entrepreneurship Development and Small Business Enterprises, Poornima M.Charantimath, 2e, Pearson, 2014.

2. Entrepreneurship, A South – Asian Perspective, D.F.Kuratko and T.V.Rao, 3e, Cengage, 2012.

REFERENCES:

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

B.TECH. METALLURGICAL AND MATERIALS ENGINEERING
MATERIAL CHARACTERIZATION TECHNIQUES
(OPEN ELECTIVE –I)

	L	T	P	C
B.Tech. III Year I Sem.				
Course Code: MM511OE	**3**	**0**	**0**	**3**

Course Objective: This course is intended to give an exposure to evaluation of special characteristics of materials (Structural, Mechanical & Thermal etc.) in order to understand their suitability in Engineering Applications

Course Outcome: At the end of the course the student will be able to characterize, identify, and apply the material to the concerned application.

UNIT-I

X-Ray Diffraction: Introduction, Production and properties of x-rays, Bragg's law of diffraction. Experimental Methods of Diffraction, Intensity of Diffracted beams - Scattering by an electron by an atom, by a unit cell, structure-factor calculations; factors affecting Diffraction Intensities.

Application of XRD: Orientation of single crystals, Effect of plastic deformation, the structure of polycrystalline Aggregates, Determination of crystal structure, Precise lattice parameter measurements, Phase - diagram determination, Order-disorder transformation, Chemical analysis by Diffraction, Stress measurement

UNIT-II

Elements of Quantitative Metallography and Image Processing.

Scanning Electron Microscopy: Principle, Interaction of electron beams with matter, Construction and Working principle Scanning Electron Microscopy, Working Distance, Depth of field, Depth of focus and Spot Size, Specimen preparation for Scanning Electron Microscopy, Different types of modes used in Scanning Electron Microscopy (Secondary Electron and Backscatter Electron) and their applications, Advantages, limitations and applications of Scanning Electron Microscopy, Electron Backscattered Diffraction.

UNIT-III

Transmission Electron Microscopy: Principle, Construction and Working principle of Transmission Electron Microscopy, Resolving power and Magnification, Depth of field and Depth of focus, Bright and dark field, Specimen preparation for the Transmission Electron Microscopy: Selected Area Diffraction, Applications of Transmission Electron Microscopy, Advantage and Limitations of Transmission Electron Microscopy.

UNIT-IV

Spectroscopy – Energy Dispersive Spectroscopy, Wavelength Dispersive Spectroscopy, Electron Probe Microanalyzer**,**

UNIT-V

Principles, Instrumentation, operation and application of thermal analysis, Thermogravimetric Analysis, TGA, Differential Scanning Calorimetry, Differential thermal analysis**,** Dynamic Mechanical Analysis, Dialatometry.

TEXT BOOKS:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008.

REFERENCES:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall , 2001 – Science

B.TECH. METALLURGICAL AND MATERIALS ENGINEERING
SCIENCE AND TECHNOLOGY OF NANO MATERIALS
(OPEN ELECTIVE - II)

B.Tech. III Year II Sem.	**L**	**T**	**P**	**C**
Course Code: MM621OE	**3**	**0**	**0**	**3**

Course Objective: This course is intended to expose the students to the most exciting area of nano materials. This would emphasize the classification, synthesis and applications of these materials.

Course Outcome: The student will be able to design a component/material that would provide us a 'better tomorrow' via nanotechnology.

UNIT-I

Introduction: History and Scopy, classification of nanostructural materials, Applications, Challenges and future prospects

UNIT-II

Unique properties of nano-materials, microstrucutre and defects in nano-crystalline materials, effect of nano-dimension on material behaviours

UNIT-III

Synthesis Routes: Bottom up approaches, top down approaches, consolidation of nano-powders.

UNIT-IV

Application of nano-materials: Nano-electronics, Micro and Nano-electromechanical systems, nano-sensors, Nano-catalyst, Structure and engineering, Automotive, Nano-medical, water and environment treatment, energy, defence and space, textile and paints**.**

UNIT-V

Nanostructured materials with high application potential: Quantum dots, Carbon nanotubes, GaN Nanowires, Nanocrystalline Zno, Nanocrystalline Tio_2, Multilayered films

TEXT BOOKS:

1. Text book of Nano Science and Technology: B S Murthy, Universities press-IIM series in Metallurgy and Material Sciene
2. Nano Essentials: T Pradeep / TMH

REFERENCES:

1. Springer Handbook of Nanotechnology
2. Nano Materials Synthersis, Properties and applications, 1996 Edlstein and Cammarate.
3. Nano Materials A.K. Bandyopadyay/ New age Publications

B.TECH. METALLURGICAL AND MATERIALS ENGINEERING
METALLURGY FOR NON METALLURGISTS
(OPEN ELECTIVE - II)

	L	T	P	C
B.Tech. III Year II Sem.				
Course Code: MM622OE	**3**	**0**	**0**	**3**

Course Objectives:

- To describe the basic principles of metallurgy and the importance of metallurgy in various discipline of engineering.
- Gain a thorough knowledge about heat treatment of steels.
- Gain knowledge about properties and uses of cast irons and non ferrous metals.
- Gain a working knowledge of basic testing methods for metals.

Course Outcomes: At the end of the course Student would be able

- To use and apply metallurgy in his own branch of engineering.
- The student will be able to justify the various testing methods adopted for metals.

UNIT-I

Introduction: Crystal structure and defects, Crystal structure of metals, Classification of steels, Carbon steels

UNIT-II

Heat Treatment of Steels: The Iron carbon systems, Common phases in steels, Annealing, Normalizing, Hardening and tempering

UNIT-III

Cast irons: Properties and applications of Ductile irons, Malleable irons, Compacted graphite iron.

UNIT-IV

Non Ferrous Metals: Properties and applications of Light Metals (Al, Be, Mg, Ti), Super alloys

UNIT-V

Testing of Metals: Hardness testing, Tensile Testing, Impact Testing, Fatigue Testing.

TEXT BOOKS:

1. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007
2. Introduction to Physical Metallurgy – SH Avner, TATA Mc GRAW HILL ,1997
3. Mechanical Metallurgy – G. E. Dieter

REFERENCES:

1. Engineering Physical Metallurgy and Heat treatment – Y Lakhtin
2. C. Suryanarayana, Experimental Techniques in Mechanics and Materials, John Wiley, John Wiley, NJ, USA, 2006
3. Foundations of Materials Science and Engineering – WF Smith

B.TECH. METALLURGICAL AND MATERIALS ENGINEERING
DESIGN AND SELECTION OF ENGINEERING MATERIALS
(OPEN ELECTIVE - III)

	L	T	P	C
B.Tech. IV Year II Sem.				
Course Code: MM831OE	**3**	**0**	**0**	**3**

Course Objective: This course aims at making student to understand and design a material for a given application considering the composition, manufacturing process and properties that are required in service.

Course Outcome: Understand the Relationship between materials selection, processing and applications.

UNIT-I
Materials selection process: Criteria for selection of materials

UNIT-II
Effect of composition, processing and structure on materials properties: Concepts in the design of industrial components

UNIT-III
Properties vs Performance materials: Aerospace and defense applications: design and alloy based on LCF, TMF, Creep fatigue interaction, hot corrosion resistance, role of DBTT for Naval applications, Intermetallics, Aluminides

UNIT-IV
Nuclear Material: Manufacturing aspects of design
Nuclear application: radiation damage, effect of radiation damage on YS, UTS, DBTT, design of alloy for fission and fusion reactors

UNIT-V
Special Materials: Manufacturing aspects of design
Selection and design of ceramics composites and polymers for specific applications,

TEXT BOOKS
1. M.F. Ashby, Materials Selection in Mechanical Design, Pergamon Press, 1992
2. G.E. Dieter, Engineering Design, A Materials and Processing Approach, 2nd ed., McGraw-Hill, 1991

REFERENCES
1. T.H. Courtney, *Mechanical Behavior of Materials*, McGraw-Hill, 1990

2. J.R. Dixon and C. Poli, *Engineering Design and Design for Manufacturing*, Field Stone Publishers, 1995

B.TECH. MINING ENGINEERING
INTRODUCTION TO MINING TECHNOLOGY
(Open Elective - I)

	L	T	P	C
B.Tech. III Year I Sem				
Course Code: MN511OE	**3**	**0**	**0**	**3**

Course Objectives: The student is expected to learn the fundamentals of mining engineering so as to encourage multi-disciplinary research and application of other branches of engineering to mining technology.

Course Outcomes: Upon completion of the course, the student shall be able to understand various stages in the life of the mine, drilling , blasting and shaft sinking**.**

UNIT-I
Introduction: Distribution of mineral deposits in India and other countries, mining contributions to civilization, mining terminology,

UNIT-II
Stages in the life of the mine - prospecting, exploration, development, exploitation, and reclamation. Access to mineral deposit- selection, location, size and shape (incline, shaft and adit), brief overview of underground and surface mining methods.

UNIT-III
Drilling: Types of drills, drilling methods, electric, pneumatic and hydraulic drills, drill steels and bits, drilling rigs, and jumbos.

UNIT-IV
Explosives: Classification, composition, properties and tests, fuses, detonators, blasting devices and accessories, substitutes for explosives, handling and storage, transportation of explosives.; Rock blasting: Mechanism of rock blasting, blasting procedure, and pattern of shot holes.

UNIT-V
Shaft sinking: Ordinary and special methods, problems, and precautions, shaft supports and lining.

TEXT BOOKS:

1. R. P. Pal, Rock blasting effect and operation, A. A. Balkema, 1st Ed, 2005.
2. D. J. Deshmukh, Elements of mining technology, Vol. 1, Central techno, 7th Ed, 2001

REFERENCE BOOKS:

1. C. P. Chugh, Drilling technology handbook, Oxford and IBH, 1st Ed, 1977.
2. R. D. Singh, Principles and practices of modern coal mining, New age international, 1st Ed, 1997.

B.TECH. MINING ENGINEERING
COAL GASIFICATION, COAL BED METHANE AND SHALE GAS
(Open Elective - II)

B.Tech. III Year II Sem	**L**	**T**	**P**	**C**
Course Code: MN621OE	**3**	**0**	**0**	**3**

Course Objectives: To specialize the students with additional knowledge on geological and technological factors of coal gasification industry mining methods of underground coal gasification, linkage techniques etc.

Course Outcomes; Student can get specialized in the underground coal gasification concepts, application and future scope in various geomining conditions.

UNIT-I
Underground Coal Gasification (UCG) Concept; Chemistry, conditions suitable for UCG, Principles of UCG., Merits and Demerits.

UNIT-II
UCG Process Component factors: Technology of UCG, opening up of coal seam for UCG.

UNIT-III
Mining methods of UCG: Chamber method, Stream method, Borehole procedure method, Blind bore hole method.

UNIT-IV
Non-Mining methods of UCG: Level seams, Inclined seams.

UNIT-V
Linkage Techniques: Pekcolation linkage, Electro linkage, Boring linkage, compressed-air-linkage, Hydraulic fracture linkage. Future Scope and Development: Innovations.

TEXT BOOKS:
1. Underground Coal Mining Methods – J.G. SINGH
2. Winning and Working Coal in India Vol.II- R. T. Deshmukh and D.J.Deshmukh.

REFERENCE BOOK:
1. Principles and Practices of Modern Coal Mining – R.D. SINGH

B.TECH. MINING ENGINEERING
SOLID FUEL TECHNOLOGY
(Open Elective - III)

B.Tech. IV Year II Sem	**L**	**T**	**P**	**C**
Course Code: MN831OE	**3**	**0**	**0**	**3**

Pre-requisites: Under graduate Physics and Chemistry

Course Objectives: Understand coal formation, properties, and their evaluation along with various issues of coal washing

Course Outcomes: Students can understand the fundamentals of
Processes of formation of coal, properties and evaluation and coal preparation and washability characteristics of coal

UNIT-I
Introduction: Processes of formation of coal, Theories of origin of coal, Eras of coal formation, Indian Coalfields and its subsidiaries: Occurrence and distribution, coal bearing formations, coal type and rank variation, Characteristics of major coalfields, Coal production from different sectors.

UNIT-II
Coal petrography: Macro and micro lithotypes, Composition of macerals, application of coal petrography, Mineral matter in coal: Origin and chemical composition, Impact of mineral matter in coal process industry.

UNIT-III
Coal properties and their evaluation: proximate and ultimate analysis, calorific value, crossing and ignition point temperature, plastic properties (free swelling index, Caking index, Gray King Low Temperature Assay, Roga index, plastometry, dilatometry).

UNIT-IV
Physical properties like specific gravity, hard groove grindability index, heat of wetting, crossing point temperature of coal, Behavior of coal at elevated temperatures and products of thermal decomposition, Classification of coal - International and Indian classification, grading of Indian coals.

UNIT-V
Coal Washing: Principles, objectives, coal preparation, washability characteristics; Selection, testing, storage and utilization of coking and non-coking coal, Use of coal by different industries.

TEXT BOOKS:

1. S. Sarkar, Fuels and Combustion, Orient Longman Private Ltd., 2nd edition, 1990
2. O. P. Gupta, Elements of Fuels, Furnaces and Refractories, Khanna Publication, 3rd Edition, 1996.

REFERENCE BOOKS:

1. M. A. Elliot, Chemistry of Coal Utilization, Wiley, 1981.
2. D. Chandra, R. M. Singh, and M. P. Singh, Text Book of Coal, Tara Book Agency, 2000.

B.TECH. MINING ENGINEERING
HEALTH AND SAFETY IN MINES
(Open Elective - III)

B.Tech. IV Year II Sem	L	T	P	C
Course Code: MN832OE	3	0	0	3

Course Objectives: To brief mining students in health and safety engineering concepts, causes of accident, training, human behavioral approach in safety etc.

Course Outcomes: student will gain knowledge and able to understand the importance of health and safety including the role of safety risk assessment in mining industry

UNIT-I

Introduction to accidents, prevention, health and safety in industry : Terminology, reason for preventing accidents – moral and legal.

Safety scenario in Indian mines, Accidents in Indian mines, Measurement of safety performance. Classification of accidents as per Mining legislation/law and general classification of accidents.

UNIT-II

Causes and preventive measures of accidents in underground and opencast mines i.e., due to fall of roof and sides, transportation of machinery, haulage and winding, drilling and blasting, movement of machinery in opencast mines and electricity etc., ; accident analysis and report, cost of accidents, statistical analysis of accidents and their importance for promotion of safety.

UNIT-III

System engineering approach to safety, techniques used in safety analysis, generic approach to loss control within mining operations. Concept of ZAP and MAP.

UNIT-IV

Risk management, Risk identification, Risk estimation and evaluation, Risk minimization techniques in mines. Risk analysis using FTA, HAZOP, ETA etc; health risk assessment and occupational diseases in mining.

UNIT-V

Development of safety consciousness, publicity and propaganda for safety; training of workmen, Human Behavioral approach in safety, safety polices and audio-visual aids, safety drives campaigns, safety audit. Safety management and organization; Internal safety organization

TEXT BOOKS:

1. Occupational Safety and Health in Industries and Mines by C.P. Singh
2. S.K. Das, Mine Safety and Legislation. Lovely Prakashan, Dhanbad, 2002

REFERENCE BOOKS:

1. N.J. Bahr, System Safety Engineering, and Risk Assessment: A Practical Approach, Taylor and Francis, NY, 1997.
2. Indian Mining Legislation – A Critical Appraisal by Rakesh & Prasad

B.TECH. PETROLEUM ENGINEERING
MATERIALS SCIENCE AND ENGINEERING
(Open Elective - I)

B.Tech. III Year I Sem.	**L**	**T/P/D**	**C**
Course Code: **PE511OE**	**3**	**0/0/0**	**3**

Course Objectives: This subject is intended to:

- Provide all the technical/engineering inputs to the learner to choose or select suitable materials of construction of chemical/petrochemical process equipment, piping and internals.
- Import expertise to the material so that it meets the specific life expectancy, by reducing the shutdown frequency.
- Learn the techniques in minimizing equipment breakdown and increasing the on-stream factor.
- To gain knowledge in choosing/selecting the material such that it withstands the severe process operating conditions such as cryogenic, high temperature, high pressure, acidic, basic, stress induced chemical/petrochemical environments keeping view the reliability and safety of the process equipment.

Course Outcome: After the course, the students will be to

- Equipped with knowledge to prepare material selection diagram, evaluation of equipment life and prediction of life of the equipment.
- Acquiring the abilities to carryout reliability studies.
- Ready to carryout equipment failure analysis and propose the remedial measures.

UNIT - I

Classification of engineering materials, Levels of Structure, Structure-Property relationships in materials, Crystal Geometry and non-crystalline(amorphous) states. Lattice –Bravais lattices, crystal systems with examples. Lattice co-ordinates, Miller and Miller- Bravais Indices for directions and places: ionic, covalent and metallic solids; packing factors and packing efficiency, ligancy and coordination number. Structure determination by Brag's X-ray diffraction method.

UNIT - II

Crystal Imperfections-classification-point defects-estimation of point defects-Dislocations-classification(edge and screw)-surface defects -dislocation motion and its relevance to mechanical and chemical properties –stress-strain relationship and diagrams for different materials(metals, non-metals, rubbers and plastics and polymers)-elastic and plastic deformation-slip -stress required to move a dislocation. Multiplication of dislocations –dislocation reactions, effect on mechanical behavior of materials. Strain hardening/work hardening –dynamic recovery and recrystallization.

UNIT - III

Fracture and failure of materials: ductile fracture analysis-brittle fracture analysis-fracture toughness-ductile-brittle transition-fatigue fracture-theory, creep and mechanism –methods to postpone the failure and fracture of materials and increase the life of the engineering components /structures.

UNIT - IV

Solid –liquid and solid-solid Equilibria for metals and alloys. Phase rule-phase diagram for pure metals (single component system),alloys(binary systems)-micro structural changes during cooling-Lever rule and its applications-typical phase diagrams-homogeneous and heterogeneous systems, formation of Eutectic, Eutectoid mixtures- non-equilibrium cooling. Binary Systems(phase diagrams) for study: Cu-Ni/Bi-Cd/Pb-Sn/ Fe-C /Al-Cu

Materials for chemical and petrochemical industrial process equipment- Effect of alloying on mechanical and chemical behavior of materials, applications of heat treatment methods for strengthening of engineering materials.

UNIT - V

Composite structures and their advantages over conventional materials–Matrix-reinforcement properties and evaluation of strength properties with different orientation of reinforcement-applications –Nano materials –synthesis and characterization.

Stability criteria of materials in chemical/petrochemical industrial environments. Corrosion and Oxidation of materials –basic mechanisms-types of corrosion, Corrosion testing and evaluation Prevailing methods to combat corrosion. Coatings –metallic non-metallic, passivity, cathodic protection.

TEXT BOOKS:

1. Materials Science and Engineering, Raghavan, V., 5th Edition, PHI, New Delhi, 2009.
2. Material Science and Engineering, Ravi Prakash, William F. Smith, and Javed Hashemi, 4th Edition, Tata-McGraw Hill, 2008.

REFERENCE BOOKS:

1 Elements of Material Science and Engineering, Lawrence H. Van Vlack, 6th Edition, Pearson, 2002.
2 Materials Science and Engineering, Balasubramaniam, R., Callister's, Wiley, 2010.
3. Corrosion Engineering, Mars G. Fontana, Tata-McGraw Hill, 2005.

B.TECH. PETROLEUM ENGINEERING
RENEWABLE ENERGY SOURCES
(Open Elective - I)

B.Tech. III Year I Sem.	L	T/P/D	C
Course Code: PE512OE	3	0/0/0	3

Course Objectives:

- To explain the concepts of Non-renewable and renewable energy systems
- To outline utilization of renewable energy sources for both domestic and industrial applications
- To analyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

Course Outcomes:

- Understanding of renewable energy sources
- Knowledge of working principle of various energy systems
- Capability to carry out basic design of renewable energy systems

UNIT-I

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO_2 reduction potential of renewable energy- concept of Hybrid systems.

UNIT-II

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT-III

Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

UNIT-IV

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

UNIT-V

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

1. **Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.
2. **Geothermal Energy**: Geothermal power plants, various types, hot springs and steam ejection.

REFERENCE BOOKS:

1. Non-Conventional Energy Sources by G.D Rai
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
3. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

B.TECH. PETROLEUM ENGINEERING
ENVIRONMENTAL ENGINEERING
(Open Elective - I)

	L	T/P/D	C
B.Tech. III Year I Sem.			
Course Code: **PE513OE**	**3**	**0/0/0**	**3**

Course Objectives: This subject provides the knowledge of water sources, water treatment, design of distribution system waste water treatment, and safe disposal methods. The topics of characteristics of waste water, sludge digestion are also included.

Course Outcomes: At the end of the course, the student will be able to:

- Analyze characteristics of water and wastewater
- Estimate the quantity of drinking water and domestic wastewater generated
- Design components of water supply systems Design sewerage system

UNIT – I

Introduction: Waterborne diseases – protected water supply – Population forecasts, design period – types of water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards: sources of water - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

UNIT – II

Layout and general outline of water treatment units – sedimentation – principles – design factors – coagulation-flocculation clarifier design – coagulants - feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation - comparison of filters – disinfection – theory of chlorination, chlorine demand - other disinfection practices- Miscellaneous treatment methods.

UNIT – III

Distribution systems requirement –method and layouts -Design procedures- Hardy Cross and equivalent pipe methods pipe – joints, valves such as sluice valves, air valves, scour valves and check valves water meters – laying and testing of pipe lines – pump house - Conservancy and water carriage systems – sewage and storm water estimation – time of concentration – storm water overflows combined flow

UNIT - IV

characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. Equation – C.O.D. Design of sewers – shapes and materials – sewer appurtenances manholes – inverted siphon – catch basins – flushing tanks – ejectors, pumps and pump houses – house drainage – components requirements – sanitary fittings-traps – one pipe and two pipe systems of plumbing – ultimate disposal of sewage – sewage farming – dilution.

UNIT – V

Waste water treatment plant – Flow diagram - primary treatment Design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – Biological treatment – trickling filters – standard and high rate – Construction and design of oxidation ponds. Sludge digestion – factors effecting – design of Digestion tank – Sludge disposal by drying – septic tanks working principles and design – soak pits.

TEXT BOOKS:

1. Environmental Engineering by H.S Peavy, D. R. Rowe, G. Tchobanog lous, McGraw Hill Education (India) Pvt Ltd, 2014
2. Environmental Engineering by D. P. Sincero and G.A Sincero, Pearson 2015.
3. Water Supply & Environmental Engineering by A.K. Chatterjee.
4. Water Supply and sanitary Engineering by G.S. Bindi, Dhanpat Rai & Sons Publishers.

REFERENCES:

1. Water and Waste Water Technology by Steel, Wiley
2. Waste water engineering by Metcalf and Eddy, McGraw Hill, 2015.
3. Water and Waste Water Engineering by Fair Geyer and Okun, Wiley, 2011
4. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr.Wiley, 2007.

B.TECH. PETROLEUM ENGINEERING
ENERGY MANAGEMENT AND CONSERVATION
(Open Elective - II)

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
Course Code: **PE621OE**	**3**	**0/0/0**	**3**

Course Objectives: To acquaint the student with the conventional energy sources and their utilization. To understand the importance of heat recovery and energy conservation methods and energy audit.

Course Outcomes: Students would have a good knowledge about conventional energy sources and their audit. Ability to apply the fundamentals of energy conservation and management.

UNIT-I

Global & Indian Energy Scenario-Classification of Energy sources-Energy needs of growing economy-Energy sector reform, Energy and Environment: Global Environmental Concerns , Basics of Energy and its various forms.

UNIT-II

Energy Audit**:** Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments. Material and Energy balance**:** Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams,

UNIT-III

Energy Action Planning, Financial Management**:** Financial analysis techniques- Risk and sensitivity analysis- Financing options, Energy performance contracts and role of ESCOs-Energy Monitoring and Targeting**:** Elements of monitoring & targeting, Data and information-analysis, Techniques -energy consumption, Production, Cumulative sum of differences (CUSUM).

UNIT-IV

Building Envelope – principles of analysis – Envelope performance -Envelope analysis of Existing and new buildings – Building standards for new and Existing constructions.
HVAC Systems types – Energy conservation opportunities – cooling equipment – Domestic hot water Estimating HVAC Energy consumption.

UNIT-V

Principles of Electric Energy Management, Energy Management control systems – Energy systems maintenance. Energy management in water and waste water treatment – solid waste treatment- air pollution control systems .

Energy Management in Boilers and Fired systems – Steam and condensate systems – cogeneration – Waste Heat recovery. Energy Management in Process Industries, Energy Security, Codes, Standards, Electricity Act, Energy Conservation Act.

TEXT BOOKS:

1. Energy Management by Murfy
2. General Aspects of Energy Management and Audit, National Productivity Council of India, Chennai (Course Material- National Certification Examination for Energy Management)

REFERENCE BOOKS:

1. Energy Management Handbook, W.C. Turner, 5th Edition, Marcel Dekker, Inc, New York, 2005.
2. Guide to Energy Management, B. L. Capehart, W. C. Turner, W. J. Kennedy, CRC Press, New York, 2005.
3. Energy Management by O.P. Collagan

B.TECH. PETROLEUM ENGINEERING
OPTIMIZATION TECHNIQUES
(Open Elective - II)

	L	T/P/D	C
B.Tech. III Year II Sem.			
Course Code: **PE622OE**	**3**	**0/0/0**	**3**

Prerequisite: Mathematics –I & Mathematics –II

Course Objectives:

- To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
- Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project implementation.

Course Outcomes: After completion of this course, the student will be able to

- explain the need of optimization of engineering systems
- understand optimization of electrical and electronics engineering problems
- apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
- apply unconstrained optimization and constrained non-linear programming and dynamic programming
- Formulate optimization problems.

UNIT – I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints.

Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT – III

Unconstrained Nonlinear Programming: One dimensional minimization methods, Classification, Fibonacci method and Quadratic interpolation method

Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method.

UNIT – IV

Constrained Nonlinear Programming: Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT – V

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOKS:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

REFERENCE BOOKS:

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

B.TECH. PETROLEUM ENGINEERING
ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES
(Open Elective – II)

	L	T/P/D	C
B.Tech. III Year II Sem.			
Course Code: **PE623OE**	**3**	**0/0/0**	**3**

Course Objective: The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

Course Outcome: It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

Unit – 1: Entrepreneurial Perspectives:
Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.
Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

Unit – 2: New Venture Creation:
Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

Unit – 3: Management of MSMEs and Sick Enterprises
Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

Units – 4: Managing Marketing and Growth of Enterprises:
Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

Units – 5: Strategic perspectives in Entrepreneurship:
Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

TEXT BOOKS:

1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.

2. Entrepreneurship, A South – Asian Perspective, D. F. Kuratko and T.V. Rao, 3e, Cengage, 2012.

REFERENCES:

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

B.TECH. PETROLEUM ENGINEERING
DISASTER MANAGEMENT
(Open Elective – III)

B.Tech. IV Year II Sem.	L	T/P/D	C
Course Code: **PE831OE**	3	0/0/0	3

Course Objectives: The subject provides different disasters, tools, and methods for disaster management.

Course Outcomes: At the end of the course, the student will be able to:

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts and planning of disaster managements

UNIT - I

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

UNIT - II

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT - IV

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India -

Organizational structure for disaster management in India - Preparation of state and district disaster management plans

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

B.TECH. PETROLEUM ENGINEERING
FUNDAMENTALS OF LIQUEFIED NATURAL GAS
(Open Elective – III)

B.Tech. IV Year II Sem.	**L**	**T/P/D**	**C**
Course Code: **PE832OE**	**3**	**0/0/0**	**3**

Course Objectives: The students will be able to:

- Gain basic knowledge of LNG and its prospective.
- Learn different liquefaction technologies of LNG.
- Have knowledge on different functional units on receiving terminals
- Analyze transportation of LNG and regasification.
- Understand HSE of LNG industry.

Course Outcomes: Upon successful completion of this course, the student will be able to:

- Have good knowledge on LNG process.
- Classify different liquefaction techniques.
- Understand different units in LNG processing and transportation.
- Have knowledge associated with safety aspects of LNG.

UNIT-I

Introduction: Overview of LNG industry: History of LNG industry – Base load LNG – Developing an LNG Project – World and Indian Scenario – Properties of LNG.

UNIT-II

Liquefaction Technologies: Propane precooled mixed refrigerant process – Description of Air products C_3MR LNG process – Liquefaction – LNG flash and storage.

Cascade process: Description of ConocoPhillips optimized cascade (copoc) process – Liquefaction – LNG flash and storage.

Other Liquefaction Processes: Description of Linde MFC LNG process- Precooling and Liquefied Petroleum Gas (LPG) recovery – Liquefaction and subcooling- Trends in LNG train capacity – strategy for grassroots plant- offshore LNG production.

UNIT-III

Supporting Functional Units in LNG Plants: Gas pretreatment: Slug catcher – NGL stabilization column – Acid gas removal unit – Molecular sieve dehydrating unit – Mercury and sulphur removal unit – NGL recovery – Nitrogen rejection – Helium recovery.

UNIT-IV

Receiving Terminals: Receiving terminals in India – Main components and description of marine facilities – storage capacity – Process descriptions.

Integration with adjacent facilities – Gas inter changeability – Nitrogen injection – Extraction of C_2^+ components.

LNG Shipping Industry & Major Equipment in LNG Industry: LNG Shipping Industry: LNG fleet – Types of LNG ships – Moss – Membrane – prismatic; Cargo measurement and calculations

UNIT-V

Major equipment in LNG industry: Cryogenic heat exchangers: Spiral – Wound heat exchangers – Plate-fin heat exchangers – Cold boxes; Centrifugal compressors – Axial compressors – Reciprocating compressors. LNG pumps and liquid expanders – Loading Arms and gas turbines.

Vaporizers: Submerged combustion vaporizers- Open rack vaporizers – Shell and tube vaporizers: direct heating with seawater, and indirect heating with seawater. Ambient air vaporizers: Direct heating with ambient air – Indirect heating with ambient air.; LNG tanks.

Safety, Security and Environmental Issues: Safety design of LNG facilities – Security issues for the LNG industry – Environmental issues – Risk based analysis of an LNG plant.

TEXT BOOK:

1. LNG: Basics of Liquefied Natural Gas, I st Edition, Stanley Huang, Hwa Chiu and Doug Elliot, PETEX, 2007.

(https://ceonline.austin.utexas.edu/petexonline/file.php/1/ebook_demos/lng/HTML/index.html.)

REFERENCE BOOKS:

1. Marine Transportation of LNG (Liquefied) and related products, Richard G. Wooler, Gornell Marine Press, 1975.
2. Marine Transportation of Liquefied Natural Gas, Robert P Curt, Timothy D. Delaney, National Maritime Research Centre, 1973.
3. Natural Gas: Production, Processing and Transport, Alexandre Rojey, Editions OPHRYS, 1997.

B.TECH. PETROLEUM ENGINEERING
HEALTH, SAFETY AND ENVIRONMENT IN PETROLEUM INDUSTRY
(Open Elective - III)

	L	T/P/D	C
B.Tech. IV Year II Sem.			
Course Code: **PE833OE**	**3**	**0/0/0**	**3**

Course Objectives:

- Knowledge of environment issues and all related Acts.
- Knowledge of drilling fluids and its toxic effects with environment.
- Proper disposal of drilling cutting after appropriate treatment.
- Treatment of produced water and makeup water and its disposal as per state pollution control board norms.
- Knowledge of oil mines regulations and proper implementation in drilling & production mines as per Act.
- Knowledge of Hazop in drilling rigs & production installations.
- Knowledge of disaster management to fight any fire accident at drilling rig/ production installation/production platform.

Course Outcomes:

- The student can have the knowledge of various Acts related to safety, Health and environment in petroleum industry.
- The student can have the knowledge of various drilling fluids handling and safe disposal such toxic products.
- Knowledge of disaster management to fight any crisis.
- Knowledge of Hazard studies and occupational health hazards in the industry.

UNIT - I

Introduction to environmental control in the petroleum industry: Overview of environmental issues- A new attitude.

Drilling and production operations: Drilling- Production- Air emissions.

UNIT - II

The impact of drilling and production operations: Measuring toxicity- Hydrocarbons- Salt- Heavy metals- Production chemicals- Drilling fluids- Produced water- Nuclear radiation- Air pollution- Acoustic impacts- Effects of offshore platforms- Risk assessment.

Environmental transport of petroleum wastes: Surface paths- Subsurface paths- Atmospheric paths. Planning for Environmental protection.

Waste treatment methods: Treatment of water- Treatment of solids- Treatment of air emissions-Waste water disposal: surface disposal.

UNIT - III

Oil mines regulations: Introduction-Returns, Notices and plans- Inspector, management and duties- Drilling and workover- Production- Transport by pipelines- Protection against gases and fires- Machinery, plants and equipment- General safety provisions- Miscellaneous- Remediation of contaminated sites- Site assessment-Remediation process.

UNIT- IV

Toxicity, physiological, asphyxiation, respiratory, skin effect of petroleum hydrocarbons and their mixture- Sour gases with their threshold limits- Guidelines for occupational health monitoring in oil and gas industry. Corrosion in petroleum industry- Additives during acidizing, sand control and fracturing.

UNIT - V

Hazard identification- Hazard evaluation- Hazop and what if reviews- Developing a safe process and safety management- Personal protection systems and measures.

Guidelines on internal safety audits (procedures and checklist)- Inspection & safe practices during electrical installations- Safety instrumentation for process system in hydrocarbon industry- Safety aspects in functional training-Work permit systems.

Classification of fires- The fire triangle- Distinction between fires and explosions- Flammability characteristics of liquids and vapors- Well blowout fires and their control- Fire fight equipment- Suppression of hydrocarbons fires.

TEXT BOOKS:

1. Environmental Control in Petroleum Engineering, John C. Reis, Gulf Publishing Company, 1996.
2. Application of HAZOP and What if Reviews to the Petroleum, Petrochemical and Chemical Process Industries, Dennis P. Nolan, Noyes Publications, 1994.
3. Oil Industry Safety Directorate (OISD) Guidelines, Ministry of Petroleum & Natural Gas, Government of India and Oil Mines Regulations-1984, Directorate General of Mines Safety, Ministry of Labor and Employment, Government of India.

REFERENCE BOOKS:

1. Guidelines for Process Safety Fundamentals in General Plant Operations Centre for Chemical Process Safety, American Institute of Chemical Engineers, 1995.
2. Guidelines for Fire Protection in Chemical, Petrochemical and Hydrocarbon Processing Facilities, Centre for Chemical Process Safety, American Institute of Chemical Engineers, 2003.
3. Guidelines for Hazard Evaluation Procedures Centre for Chemical Safety, Wiley-AIChE, 3rdEdition, 2008.
4. Guideline for Process Safety Fundamentals in General Plant Operations, Centre for Chemical Process Safety, AIChE, 1995.
5. Chemical Process Industry Safety, K S N Raju, McGraw Hill, 2014.