ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

ELECTRICAL & ELECTRONICS ENGINEERING

FOR

B. TECH FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2018-2019)

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (For Women)

(AUTONOMOUS)

Shaikpet, Hyderabad – 500104

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

VISION

To impart quality education in Electrical & Electronics Engineering for women empowerment.

MISSION

The vision can be accomplished by

- Imparting fundamental knowledge in Electrical and Electronics Engineering through well-qualified faculty
- Providing exposure to current technologies
- Providing hands-on experience to meet the expectations of the industry
- Facilitating individual and team activities to enhance personality and soft skills

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B.TECH-ACADEMIC REGULATIONS – 2018 (GNITS-R18)

For CBCS Based B.Tech. Degree Courses

(Applicable for the students of B.Tech (Regular) from the Academic Year **2018-19** and onwards)

1.0 Under-Graduate Degree Course (UGDC) in Engineering & Technology (E&T)

G. Narayanamma Institute of Technology & Science (GNITS) - for Women, Hyderabad, affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, offers 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Course under Choice Based Credit System (CBCS) with effect from the Academic Year 2018 – 19 onwards in the following Branches of Engineering & Technology:

S.No.	***Branch***
I.	Computer Science and Engineering (CSE)
II.	Electrical and Electronics Engineering (EEE)
III.	Electronics and Communication Engineering (ECE)
IV.	Electronics and Telematics Engineering (ETE)
V.	Information Technology (IT)

2.0 Eligibility for Admission

2.1 The Admission to the UGDC shall be made either on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (TSEAMCET), OR the University, OR on the basis of any other order of merit approved by the University, subject to the reservations as prescribed by the Government from time to time.

2.2 The medium of instruction for the entire UG Degree Course in E&T shall be ENGLISH only.

3.0 B.Tech. Degree Course Structure

3.1 The B.Tech. Degree Courses at GNITS are of Semester Pattern, with 8 Semesters constituting 4 Academic Years and each Academic Year is of TWO Semesters (First/Odd and Second/ Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/AICTE specified Definitions/Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are listed under **3.2.1 to 3.2.4**. The Course Structure is organized based on the AICTE Model Curriculum for Under-Graduate Degree Courses in Engineering & Technology (Jan. 2018).

3.2.1 Semester Scheme:

Each UGDC is of 4 Academic Years (8 Semesters), with each academic year divided into two semesters of 22 weeks (≥ 90 working days) each. Each semester has - 'Continuous Internal Evaluation (CIE)' and 'End Semester Examination or Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC, and Course Structure/Curriculum as suggested by AICTE are followed. The terms 'SUBJECT' or 'COURSE' imply the same meaning here, and refers to 'Theory Subject', or 'Lab/ Practical Course', or 'Design/ Drawing Subject', or 'Elective', or 'Seminar', or 'Project', or 'Mini-Project', as the case may be.

3.2.2 Credit Courses

All the Subjects/ Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject/ Course in a **L : T : P : C** (**L**ecture Periods : **T**utorial Periods : **P**ractical Periods : **C**redits) Structure based on the following general pattern:

- One Credit - for One hour/ Week/ Semester for Theory/ Lecture (L) Courses, and Tutorials (T); and,
- One Credit - for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses.

Student Activity Courses like NCC, NSS, NSO, and other courses identified as Mandatory Courses (MC) shall not carry Credits.

3.2.3 Subject/ Course Classification

All the Subjects/ Courses offered for the UGDC are broadly classified as :

(a) Foundation Courses (FnC), (b) Core Courses (CoC), and (c) Elective Courses (ElC).

➢ Foundation Courses (FnC) are further categorized as :

(i) HS (Humanities and Social Sciences including Management Courses),

(ii) BS (Basic Sciences Courses), and

(iii) ES (Engineering Sciences Courses);

- Core Courses (CoC) and Elective Courses (ElC) are categorized as PS (Professional Subjects), which are further subdivided as:

  (i) PC (Professional/ Departmental Core) Courses

  (ii) PE (Professional/ Departmental Electives) Courses

  (iii) OE (Open Electives) Courses; and

  (iv) Project Works (PW);

- Additional Courses :
  - ONLINE Courses (offered by IITs/ MOOCs) ; and
- Mandatory Courses :
  - MC - No Credits allocated.

3.2.4 Course Nomenclature:

The Curriculum Nomenclature or Course Structure Grouping for each UG Degree Course (B.Tech. Degree Programmes) is as listed below (along with AICTE specified % Range of Total Credits):

4.0 Course Work

S. No	*Broad Course Classification*	*Course Group/ Category*	*Course Description*	*Range of Credits & AICTE Model Credits*
1)	**Foundation Courses (FnC)**	**BS – Basic Sciences**	Include - Mathematics, Physics, Chemistry, Biology Subjects	**15% - 20%**
2)		**ES - Engineering Sciences**	Include fundamental engineering subjects	**15% - 20%**
3)		**HS – Humanities & Social Sciences**	Include subjects related to Humanities, Social Sciences and Management	**5% - 10%**
4)	**Core Courses (CoC)**	**PC – Professional Core**	Include core subjects related to the Parent Department/ Branch of Engg.	**30% - 40%**

5)	**Elective Courses (EtC)**	**PE – Professional Electives**	Include Elective subjects related to the Parent Department/ Branch of Engg.	**10% - 15%**
6)		**OE – Open Electives**	Elective subjects include subjects from other technical and/ or Emerging Subject Areas	**5% - 10%**
7)	**Projects Related Courses (PW)**	**Project Work**	B.Tech. Project or UG Project or UG Major Project	**10% - 15%**
8)		**Mini-Project**	Mini-Project/Industrial Training / Internship/ UG Mini-Project	
9)		**Seminar**	Seminar based on core contents related to Parent Department/ Branch of Engg.	
10)	**Mandatory Courses**	**MC**	Mandatory Courses	**Non-Credit**
11)	**Additional Courses**	**ONLINE Courses**	Offered by IITs/ MOOCs	Optional
Total Credits for UGDC (B. Tech.) Programme				**160 (100%)**

4.1 A student after securing admission shall pursue the B.Tech. UG Degree Course in a minimum period of 4 Academic Years, and a maximum period of 8 Academic Years (with effect from the Date of Commencement of I Year).

4.2 As suggested by AICTE, a 3-week 'Mandatory Induction Programme' shall be offered for all the Branches of Engineering at the start of the I Year UGDC, to enable the newly admitted students get acquainted with the new professional environment, to develop awareness and understanding of the engineering education requirements, and to get them prepared for the academic schedules ahead. The features, activities and pattern

of the Induction Programme shall be as per the guidelines suggested in the Model Curriculum. Conventional class work shall commence only after the completion of the Induction Programme.

4.3 Each student shall Register for and secure the specified number of Credits (160 Credits) required for the completion of the UGDC and the Award of the B.Tech. Degree in the respective Branch of Engineering.

4.4 Each Semester is structured to provide typically about 20 Credits (20 C) on an average, totaling to 160 Credits (160 C) for the entire B.Tech. Programme.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each B.Tech student and the faculty advisor assigned shall advise/counsel the student about the UGD Course, its Course Structure and Curriculum, Choice/Option for Subjects/Courses, based on the competence, progress, pre-requisites and interest of the student.

5.2 The Academic/Examination Section of the College invites 'Registration Forms' from the students apriori (before the beginning of the Semester) through 'ONLINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ONLINE Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

5.3 Every individual student is advised to register for all the number of credits indicated in that semester workload of the respective UGD Course Structure - this is termed as the 'Minimum Work Load' (MWL).

5.4 A student can apply for ONLINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from her assigned Faculty Advisor, which should be submitted to the College Academic/Examination Section through the Head of the Department (a copy of the same is to be retained by the Head of the Department, Faculty Advisor and the student).

5.5 A student may be permitted to register for the Subjects/ Courses of her choice with the typical work load suggested in the respective semester credit load allocation of that UG Degree Course Structure as the Minimum Work Load (MWL),

and maximum – with possible additional courses of her choice, limited to a Total Work Load (TWL) of 25 C, based on her PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses in the Department Course Structure and Syllabus contents.

5.6 The choice for the 'additional' Subjects/Courses to reach the Maximum Permissible Limit of 25 Credits (above the typical MWL) must be indicated clearly, which needs the specific approval and signature of the Faculty Advisor/ Counselor and the HoD on the hard-copy.

5.7 If the student submits ambiguous choices or multiple options or erroneous entries during ONLINE 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 shall be taken into consideration, as applicable.

5.8 The Subject/Course Options exercised through ONLINE Registration are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices shall also be not 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 on account of any unforeseen or unavoidable 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), which may be considered. Such alternate arrangements shall be made by the Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of class-work for that semester.

5.9 Dropping of the Subjects/ Courses may be permitted ONLY AFTER obtaining the prior approval from the Faculty Advisor assigned (subject to the retaining of the MWL), 'within 15 Days of Time' from the beginning of the current semester.

5.10 For the Mandatory Courses (like NCC/ NSS/ NSO etc.), a 'Satisfactory Participation Certificate' from the concerned authorities of the relevant semester is essential. No Marks or Grades or Credits shall be awarded for the Mandatory Courses.

6.0 Subjects/ Courses to be offered

6.1 A typical Section strength (or Class strength) for each semester shall be 60.

6.2 A Subject/ Course may be offered to the students, ONLY IF a Minimum of 30 Students opt for the same. The Maximum Class Strength of a Section is limited to 80.

6.3 More than ONE TEACHER may offer the SAME SUBJECT (Theory/ Tutorials/Lab./Practicals) in any semester. However, selection choice for students will be based on - 'FIRST COME FIRST SERVE Basis and CGPA Criterion' (ie., the first focus shall be on the earliest stamping of ONLINE ENTRY from the student for Registration in that semester, and the second focus, if needed, shall be on the existing CGPA of the student).

6.4 If more entries for the Registration of a Subject come into picture, then the Head of the Department concerned shall take necessary action, whether to offer such a Subject/ Course for TWO (or multiple) SECTIONS or NOT .

6.5 In case of the options coming from the students of the other Departments/ Branches/ Disciplines also (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the 'Parent Department/Branch' first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the End Semester Examinations if she acquires a minimum of 75% of attendance in aggregate of all the Subjects/Courses (excluding Mandatory or Non-Credit Courses) for that semester.

7.2 Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be granted by the College Academic Committee (CAC) on genuine and valid grounds based on the student's representation with supporting evidence. Provision of such condonation is however limited to a maximum of 3 times during the maximum permissible UG study period.

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

7.4 Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

7.5 A student, whose shortage of attendance is not condoned in a semester is not eligible to take her End Examinations of that semester; she gets detained and her registration for that semester shall stand cancelled. She shall not be promoted to the next semester. She may seek re-registration for all those Subjects registered in that semester in which she gets detained by seeking re-admission for 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 Elective category.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied in addition to the Attendance Requirements mentioned under Clause 7.0.

8.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if she secures not less than 35% marks (25 out of 70 marks) in the End Semester 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].

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to the Seminar and the Mini-Project, if she secures not less than 40% of the total marks (that is, 40 marks) to be awarded for each. The student would be treated as failed, if she - (i) does not submit a report on her Mini-Project, or does not make a presentation of the same before the Evaluation Committee as per the schedule, or (ii) does not present the Seminar as required in the III year II Semester, or (iii) secures less than 40% of marks (40 marks) in the Mini-Project/ Seminar evaluations. She may have to reappear for the Mini-Project/ Seminar evaluations, when they are scheduled again in that semester; if she fails in such 'one reappearance' evaluation also, she has to reappear for the same in the next subsequent semester, as and when they are scheduled as supplementary candidate.

8.3 A student will not be promoted from the I Year to the II Year, unless she fulfills the Attendance and Academic Requirements and secures a total of 19 Credits out of 38 Credits specified for the I Year, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

8.4 A student will not be promoted from the II Year to the III Year, unless she fulfills the Attendance and Academic Requirements and secures a total of 47 Credits out of 79 Credits specified up to and inclusive of the II Year II Semester, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

8.5 A student will not be promoted from the III Year to the IV Year, unless she fulfils the Attendance and Academic Requirements and secures a total of 71 Credits out of 119 Credits specified up to and inclusive of the III Year II Semester, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

8.6 A student shall register for all the Subjects covering 160 Credits as specified and listed (with the relevant Course/ Subject Classifications as mentioned) in the Course Structure, puts up all the Attendance and Academic requirements for 160 Credits securing a minimum of C Grade (Pass Grade) or above in each Subject, and earns ALL 160 Credits securing SGPA ≥ 5.0 (in each semester), and CGPA (at the end of each successive semester) ≥ 5.0 to successfully complete the UG Degree Course.

8.7 If a student registers for any 'additional Subjects' (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totaling to 160 Credits as specified in the Course Structure of her Department, the performances in those 'additional Subjects' (although evaluated and graded) shall not be taken into account while calculating the SGPA and CGPA. For such 'additional Subjects' registered, the Letter Grade alone shall be indicated in the Grade Card as a performance measure subject to the completion of the Attendance and Academic Requirements as stated under Clauses 7.0 and 8.1 – 8.6.

8.8 Students who fail to earn 160 Credits as per the Course Structure, and as indicated above, within 8 Academic Years from the Date

of the Commencement of their I Year, shall forfeit their seats in B.Tech. Programme and their admission shall stand cancelled.

8.9 When a student is detained due to the shortage of attendance in any semester, she may be re-admitted into that semester as and when offered, along with the Academic Regulations of the Batch into which she gets readmitted. However, no Grade Allotments or SGPA/ CGPA calculations shall be done for that entire semester in which she got detained.

8.10 When a student is detained due to lack of Credits in any year, she may be readmitted in the next year(s), after the fulfillment of the Academic Requirements, along with the Academic Regulations of the Batch into which she gets readmitted.

8.11 A student who is eligible to appear for the End Semester Examination in any Subject / Course, but is absent for a particular subject/course or has failed (thereby failing to secure C Grade or above), may reappear for that Subject/ Course at the supplementary examination (SEE) as and when conducted. In such cases, her Internal Marks (CIE) assessed earlier for that Subject/Course shall be retained and carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating her performance in that Subject.

8.12 In view of AICTE/UGC suggestions and guidelines, it is resolved to recommend the inclusion of **"INTERNSHIP" for B.Tech Programme students**, in the 8th Semester (4th Year 2nd Semester), for One Semester Duration, in addition to the B.Tech. Project requirements already specified, with the following notes …

i. The internship will be "Industry Internship", and is exclusively meant for all those students who have been considered eligible and selected accordingly by the Industry. Based on such selection letters from the Industry, approvals will be given to individual students by the Head of Department and the Principal of the Institution to carry out the Industry Internship for One Semester. The Internship Performance will be evaluated by the Supervisor/Advisor/Guide from the Industry for 100 marks (there will not be any Internals/Sessionals from the department side), and a Certificate is to be issued to that effect from the Industry. The Internship will carry a weightage of 3 Credits, and all students who undergo Internship Programme are

exempted from the prescribed Open Elective Course of B.Tech.– 4th Year 2nd Semester (which is also for 3 Credits).

ii. If any student fails to complete this Internship Programme due to any reason whatsoever, or fails to secure at least 50% marks in their Internship Performance Evaluation, she would have to register for the previously exempted Open Elective Course of 4th Year 2nd Semester, in the next subsequent semester(s), as a 'supplementary candidate', and complete all the academic requirements as needed.

iii. Because of the mandatory physical presence of the student required at the Industry during the Internship Period, provision is made to the effect that *students may be permitted to choose ONE ON-LINE Course (of NPTEL/MOOCS level - for 3 Credit Weightage), in place of the existing Professional Elective Course (Professional Elective – 6) in 4th Year 2nd Semester of the B.Tech Programme, preferably in the same domain specialization, subject to acceptance and approval by the Head of Department, during 3rd year – 2nd semester or 4th year- 1st semester, as applicable*. In such cases, the student's performance evaluation will be as per the ON-LINE Course evaluation format. If any student fails to get the required Grade/Marks in her ON-LINE Course evaluations, she would have to repeat the same ON-LINE Course again (as and when offered) and complete it successfully, or can register for *Professional Elective – 6 in 4th Year 2nd Semester* to meet all the academic requirements.

9.0 Evaluation-Distribution and Weightage of Marks

9.1 The performance of a student in each semester shall be evaluated Subject-wise (irrespective of the Credits assigned) with a maximum of 100 marks for Theory, or Labs/Practicals, or Drawing/Design, or Elective Course, or Seminar, or Mini-Project, or Project – I, or Project – II etc. These evaluations shall be based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination), and a Letter Grade corresponding to the % of marks obtained shall be given.

9.2 For all the Subjects/ Courses as mentioned under **9.1**, the distribution shall be: 30 Marks for the CIE and 70 Marks for the SEE for the entire UG Degree Course.

9.3 a. For the Theory Subjects during the semester, there shall be 2 mid-term examinations for 25 marks each. Each mid-term examination consists of one Objective section for 10 marks, plus one Subjective section for 15 marks, with a total duration of 120 minutes. Further, there shall be an allocation of 5 marks for the Assignment, and there shall be 2 Assignments. The Objective section may be set with multiple choice questions, True/False selections, fill-in the blanks, matching type questions, etc. The Subjective section shall contain 5 questions, out of which the student has to answer any 3 questions, each question carrying 5 marks.

b. The first mid-term examination shall be conducted in the middle of the semester for the first 50% of the syllabus, and the second mid-term examination shall be conducted at the end of the semester for the remaining 50% of the syllabus.

c. The First Assignment should be submitted before the conduct of the first mid-term examination, and the Second Assignment should be submitted before the conduct of the second mid-term examination. The Assignments shall be as specified by the subject teacher concerned.

d. The first mid-term examination marks and the first Assignment Marks combined together shall make one set of CIE marks, and the second mid-term examination marks and the second Assignment Marks shall make the second set of CIE marks; and the AVERAGE of the two sets of mid examination marks shall be taken as the final marks secured by the student towards Continuous Internal Evaluation (CIE) in that Theory Subject.

9.4 For the Lab/Practical Subjects, the Continuous Internal Evaluation (CIE) during the semester shall be for 30 Marks, and the End Semester Examination (SEE) shall be for 70 Marks. Out of the 30 Marks for internals (CIE), day-to-day assessment of the lab work shall be assessed for 20 Marks; and one internal lab exam shall be conducted by the laboratory teacher concerned for 10 Marks. The Semester End Examination (SEE) for Lab/Practicals shall be conducted at the end of the semester by Two Examiners nominated by the Head of the Department and approved by the Principal.

9.5 For the Subjects with Design and/or Drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation etc.), the distribution shall be: 30 Marks for CIE (20 Marks for the day-to-day work and 10 Marks for the internal tests) and 70 Marks for SEE. There shall be TWO internal tests in a semester and the AVERAGE of the two shall be taken into consideration for the award of Marks for the internal tests (CIE).

9.6 **Open Electives**: 4 Open Elective Courses shall be offered in the 8 Semester UG Degree Course. Students are to choose ONE from each set of Open Electives given. However, students cannot opt for an Open Elective Subject offered by their own (parent) Department or any other department, if it has been already listed (or the contents included) under any category of the Subjects offered by the parent department in any semester.

9.7 There shall be a Seminar Presentation in the III Year II Semester. For the Seminar, the student shall collect the information on a technical topic, prepare a Technical Report and submit the Technical Report prepared to the Department at the time of Seminar Presentation. The Seminar Presentation (along with the Technical Report submitted) shall be evaluated for 100 marks by Two Faculty Members assigned by the Head of the Department. There shall be no SEE or external examination for the Seminar.

9.8.a. There shall be a Mini-Project, preferably in collaboration with an Industry with the relevant specialization, to be registered immediately after III Year II Semester examinations, and taken up during the summer vacation (between III and IV Years) for about eight weeks duration.

b. The Mini-Project work shall be submitted in a Report form, and a presentation of the same shall be made before a Committee and is evaluated for 100 Marks by the committee. The Committee shall consist of the Head of the Department, the supervisor of Mini-Project, and a Senior Faculty Member of the Department. There shall be no internal marks for Mini-Project. Performance evaluation of the Mini-Project shall be included in the IV Year I Semester Grade Card.

9.9 Each student shall start the Project Work during the IV Year I Semester as per the instructions of the Project Guide/ Project Supervisor assigned by the Head of the Department.

a. The Project Work shall be divided and carried out in 2 phases: Phase – I (Project-I) during IV Year I Semester, and Phase – II (Project-II) during IV Year II Semester, and the student has to prepare two independent Project Work Reports – *one each during each phase*. First Report shall include the Project Work carried out under Phase – I, and the Second Report (Final Report) shall include the Project Work carried out under Phase – I and Phase – II put together. Phase – I and Phase – II of the Project Work shall be evaluated for 100 marks each.

b. Out of the total 100 marks allotted for each Phase of the Project Work, 30 marks shall be for the CIE (Continuous Internal Evaluation/CIE), and 70 Marks shall be for the End Semester Viva-voce Examination/SEE). The Marks earned under CIE for both Phases of the Project shall be awarded by the Project Guide/Supervisor (based on the continuous evaluation of student's performance during the two Project Work Phases/periods); and the marks earned under SEE shall be awarded by the Project Viva-voce Committee/ Board (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).

c. For the Project Phase - I, the Viva-voce shall be conducted at the end of the IV Year I Semester, before the commencement of that Semester End Examinations, at the Department Level by a Committee comprising of the HOD or One Professor and Supervisor (no external examiner), and the Project Phase – II (or Final Project Viva-voce) shall be conducted by a Committee comprising of an External Examiner, the Head of the Department and the Project Supervisor at the end of the IV Year II Semester, before the the commencement of semester end examinations. The nomination of the External Examiner shall be done by the Principal from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the HOD.

9.10 For NCC/ NSS/ NSO Mandatory Courses and/or any other Mandatory Non-Credit Course offered in a semester, a 'Satisfactory Participation Certificate' shall be issued to the student from the authorities concerned, only after securing ≥ 75% attendance in the Course. No Marks or Letter Grade shall be allotted for the Mandatory Courses.

10.0 Grading Procedure

10.1 Marks shall be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Workshop/Drawing, or Elective Course, or Seminar, or Project, or Mini-Project, etc., and, based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified under 9.0, a corresponding Letter Grade shall be given

10.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

% of Marks Secured (Class Intervals)	*Letter Grade (UGC Guidelines)*	*Grade Points*
90% and above (≥ 90% ,≤ 100%)	**O (Outstanding)**	**10**
Below 90% but not less than 80% (≥ 80% ,< 90%)	**A^+ (Excellent)**	**9**
Below 80% but not less than 70% (≥ 70% ,< 80%)	**A (Very Good)**	**8**
Below 70% but not less than 60% (≥ 60% ,< 70%)	**B^+ (Good)**	**7**
Below 60% but not less than 50% (≥ 50% ,< 60%)	**B (above Average)**	**6**
Below 50% but not less than 40% (≥ 40% ,< 50%)	**C (Pass)**	**5**
Below 40% (< 40%)	**F (FAIL)**	**0**

10.3 A student obtaining **'F'** Grade in any Subject shall be considered 'FAILED' and will be required to reappear as 'Supplementary Candidate' in the End Semester Examination (SEE), as and when conducted. In such cases, her Internal Marks (CIE Marks) in those Subject(s) will remain the same as those obtained earlier.

10.4 A Letter Grade does not imply any specific % of marks.

10.5 In general, a student shall not be permitted to repeat any Subject/ Course (s) for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, she has to repeat all the

Subjects/Courses pertaining to that semester, when she is detained (as listed under Clauses 8.9- 8.10).

10.6 A student earns Grade Points (GP) in each Subject/ Course on the basis of the Letter Grade obtained by her in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Points with Credits for that particular Subject/Course.

Credit Points (CP) = Grade Points (GP) x Credits for a Course

10.7 The student passes the Subject/ Course only when she gets GP ≥ 5 (C Grade or above).

10.8 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

SGPA = $\{\sum_{i=1}^{N} C_i G_i\} / \{\sum_{i=1}^{N} C_i\}$ ….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.

10.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all the semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL the registered Courses in ALL the 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 Second Semester onwards, at the end of each semester, as per the formula

CGPA= $\{\sum_{j=1}^{M} C_j G_j\}/\{\sum_{j=1}^{M} C_j\}$ …for all S semesters registered (ie., 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' from the 1st Semester onwards upto and inclusive of the semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S 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 the registration and completion of I Year I Semester however, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

10.10 For the Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs shall be used.

10.11 For Calculations listed under Clauses 10.6 – 10.10, performance in failed Subjects/ Courses (securing F Grade) shall also be taken into account, and the Credits of such Subjects/ Courses shall also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.

10.12 Passing Standards

10.12.1 A student shall be declared successful or 'passed' in a semester, only when she gets a SGPA ≥ 5.00 (at the end of that particular semester); and a student shall be declared successful or 'passed' in the entire UG Degree Course, only when she gets a CGPA ≥ 5.00; subject to the condition that she secures a GP ≥ 5 (C Grade or above) in every registered Subject/ Course in each semester (during the entire UG Degree Course) for the Award of the Degree, as required.

10.12.2 A student shall be declared successful or 'passed' in any Non-Credit Subject/ Course, if she secures a 'Satisfactory Participation Certificate' for that Mandatory Course.

10.13 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 the Credits earned. The Grade Card or the Grade Sheet shall show the details of the Courses Registered (Course Code, Title, No. of Credits, 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 under Clauses 10.6 – 10.10.

11.2 CGPA is NOT indicative of the % of marks secured. However, in case if % of marks equivalent to the FINAL CGPA (computed at the end of UG Degree Course) is required, then the following formula may be used as an estimate:

% 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, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire UG Degree Course, and secures the required number of 160 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 under Clause 12.1, shall be placed in the following four Classes :

12.2.1a. A student with final CGPA (at the end of the UG Degree Course) ≥ 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 her First Academic Year,

(ii) should have secured a CGPA ≥ 8.00, at the end of each of the 8 sequential semesters, starting from the 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'.

b. A student with final CGPA (at the end of UG Degree Course) ≥ 8.00, but not fulfilling the above conditions, shall be placed in 'FIRST CLASS'.

12.2.2 A student with final CGPA (at the end of the UG Degree Course) ≥ 6.50 but <8.00, shall be placed in 'FIRST CLASS'.

12.2.3 A student with final CGPA (at the end of the UG Degree Course) ≥ 5.50 but <6.50, shall be placed in 'SECOND CLASS'.

12.2.4 All other students who qualify for the Award of the Degree (as per the Clause 12.1), with final CGPA (at the end of the UG Degree Course) ≥ 5.00 but < 5.50, shall be placed in 'PASS CLASS'.

12.2.5 A student with final CGPA (at the end of the UG Degree Course) < 5.00 will not be eligible for the Award of the Degree.

12.2.6 A student fulfilling the conditions listed under the Clause 12.2.1 (a) alone will be the eligible candidate for the 'University/College Rank' and/or 'Gold Medal' considerations.

13.0 Withholding of Results

13.1 If the student has not paid fees to the University/ College at any stage, or has pending dues against her name due to any reason whatsoever, or if any case of indiscipline is pending against her, the result of the student may be withheld, and she shall 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

14.1 A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed in her B.Tech. Degree Course after the UGDC period of 4 years, may be considered eligible for readmission to the same Subjects/ Courses (or equivalent Subjects/ Courses, as the case may be), and/ or to the same Professional Electives/ Open Electives (from the same set/ category of Electives available or equivalents suggested, as the case may be) as and when she is offered (within the time-frame of 8 years from the Date of Commencement of her I Year I Semester), along with the Academic Regulations of the Batch into which she gets readmitted.

15.0 Student Transfers

15.1 There shall be no Branch transfers after the completion of the Admission Process.

16.0 Scope

i) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".

ii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

iv) The College 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 the students with effect from the dates notified by the College Authorities.

ACADEMIC REGULATIONS - 2018

For CBCS Based B.Tech. Degree Courses for Students Admitted under Lateral Entry Scheme (LES)

(Effective for the students admitted into II year from the Academic Year **2019-20** and onwards)

A) Eligibility for Admission

A.1 The Admission to the B.Tech. Programme (UG Degree Course) shall be made either on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (TSECET), OR the University, OR on the basis of any other order of merit approved by the University, subject to the reservations as prescribed by the Government from time to time.

B) B.Tech. Degree Course Structure for LES Students ~

B.1 Regular Full Time B.Tech. Degree Courses at GNITS are of Semester Pattern, with 8 Semesters constituting 4 Academic Years and each Academic Year is of TWO Semesters (First/Odd and Second/Even Semesters). Students admitted under LES shall join - the II Year stream of the Regular B.Tech. students in the relevant branch of engineering (admitted for 4 Year UG Degree Course in the previous year) and their UG Degree Course period therefore shall be 3 Years (II, III and IV Years) or 6 Semesters of the Regular Full Time B.Tech. Programme (commencing from II Year I Semester).

B.2 The LES Students, after securing admission, shall pursue their UG Degree course of study for not less than 3 years and not more than 6 years, from the year of admission.

B.3 Each student shall Register for and secure the specified number of Credits (122 Credits) required for the completion of the UGDC and the Award of the B.Tech. Degree in the respective Branch of Engineering.

C) Academic Requirements ~

C.1 A student will not be promoted from the II Year to the III Year, unless she fulfills the Attendance and Academic Requirements and secures a total of 24 Credits out of 41 Credits specified up to and inclusive of the II Year II Semester, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

C.2 A student will not be promoted from the III Year to the IV Year, unless she fulfils the Attendance and Academic Requirements and secures a total of 48 Credits out of 81 Credits specified up to and inclusive of the III Year II Semester, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

C.3 A student shall register for all the Subjects covering 122 Credits as specified and listed (with the relevant Course/ Subject Classifications as mentioned) in the Course Structure, puts up all the Attendance and Academic requirements for 122 Credits securing a minimum of **'C'** Grade (Pass Grade) or above in each Subject, and earns ALL 122 Credits securing SGPA ≥ 5.0 (in each semester), and ≥ 5.0 CGPA (at the end of each successive semester), to successfully complete the B.Tech. Degree Course.

C.4 A student who fails to earn 122 Credits specified as per the Course Structure, and as indicated above, within 6 Academic Years from the year of admission (that corresponds to the II Year I Semester of the Regular Full Time B.Tech. Degree Course), shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled.

D) Award of Degree

D.1 A student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire UG Degree Course, and secures the required number of 122 Credits (with CGPA ≥ 5.0), within 6 Academic Years from the year of admission, 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.

D.2 A student who qualifies for the Award of the Degree as listed under Clause **D.1**, shall be placed in the following Classes :

D.2.1 a) A student with final CGPA (at the end of the UG Degree Course) ≥ 8.00, and fulfilling the following conditions -

(i) should have passed all the Subjects/Courses in 'FIRST APPEARANCE' within the first 3 Academic Years (or 6 Sequential Semesters) from the year of admission,

(ii) should have secured a CGPA ≥ 8.00, at the end of each of the 6 sequential semesters, starting from the II 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'.

b) A student with final CGPA (at the end of UG Degree Course) ≥ 8.00, but not fulfilling the above conditions, shall be placed in 'FIRST CLASS'.

D.2.2 A student fulfilling the conditions listed under the Clause D.2.1 (a) alone will be the eligible candidate for the 'University/ College Rank' and/or 'Gold Medal' considerations.

D.2.3 All other clauses (and the corresponding CGPAs) shall be same as those listed under clauses 12.2.2 to 12.2.5.

E) Other Regulations

All the Academic Regulations as applicable for the B.Tech. 4 Year Degree Course students shall hold good for the B.Tech. Lateral Entry Scheme students also, but for the variations as described above, under Clauses A, B, C and D for LES students.

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.

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 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 dutyin 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.	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 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 end 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 any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the 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 Principal for further action to award suitable punishment.	

B.Tech. 4 Year (8 semesters) Regular Programme in Electrical & Electronics Engineering

COURSE STRUCTURE

(Applicable for the Batch admitted from the Academic Year 2018-19 onwards)

I YEAR **I SEMESTER**

S.No.	Group	Sub Code	Subject	L	T	P	Credits
1.	BS	BS111AC	Physics	3	1	-	4
2.	BS	BS111AB	Linear Algebra and Multivariable Calculus	3	1	-	4
3.	ES	ES111AF	Programming for Problem Solving	3	-	-	3
4.	ES	ES111AE	Engineering Graphics	1	-	3	2.5
5.	ES	ES11104	Engineering Workshop	1	-	3	2.5
6.	BS	BS11102	Physics Lab	-	-	3	1.5
7.	ES	ES11105	Programming Lab	-	-	3	1.5
8.	MC	MC11106	Games and Sports	2	-	-	-
			TOTAL	**13**	**2**	**12**	**19**

I YEAR **II SEMESTER**

S.No	Group	Sub Code	Subject	L	T	P	Credits
1.	BS	BS112AA	Chemistry	3	1	-	4
2.	BS	BS112AG	Numerical Techniques and Transform Calculus	3	1	-	4
3.	HS	HS112AJ	English	2	-	-	2
4.	ES	ES112AD	Basic Electrical Engineering	3	1	-	4
5.	BS	BS11207	Chemistry Lab	-	-	2	1
6.	HS	HS11212	English Professional and Communication Skills Lab	-	-	2	1
7.	ES	ES11209	Basic Electrical Engineering Lab	-	-	3	1.5
8.	ES	ES11210	Computational Mathematics Lab	-	-	3	1.5
9.	MC	MC11213	National Service Scheme (NSS)	2	-	-	-
			TOTAL	**13**	**3**	**10**	**19**

Games & Sports /NSS Participation Certificate is Mandatory for each semester

B.Tech. 4 Year (8 semesters) Regular Programme in Electrical & Electronics Engineering

COURSE STRUCTURE

(Applicable for the Batch admitted from the Academic Year 2018-19 onwards)

II YEAR **I SEMESTER**

S.No.	Group	Sub Code	Subject	L	T	P	Credits
1.	BS	BS113AK	Mathematical Analysis	3	-	-	3
2.	ES	ES113AM	Circuits Theory	3	-	-	3
3.	PC	PC113AR	Analog Electronics	3	-	-	3
4.	PC	PC113AU	Electrical Machines-I	3	1	-	4
5.	PC	PC113AV	Electromagnetic fields	3	-	-	3
6.	ES	ES11315	Circuits Lab	-	-	3	1.5
7.	PC	PC11318	Analog Electronics lab	-	-	3	1.5
8.	PC	PC11321	Electrical Machines -I Lab	-	-	3	1.5
9.	MC	MC11317	Gender Sensitization	2	-	-	-
			TOTAL	**17**	**1**	**9**	**20.5**

II YEAR **II SEMESTER**

S.No	Group	Sub Code	Subject	L	T	P	Credits
1.	BS	BS114BB	Transform Techniques and Applications	3	-	-	3
2.	ES	ES114BC	Material Science	3	-	-	3
3.	PC	PC114BK	Digital Electronics	3	-	-	3
4.	PC	PC114BL	Electrical Machines -II	3	1	-	4
5.	PC	PC114BP	Power Systems-I	3	-	-	3
6.	PC	PC11430	Electrical Machines-II Lab	-	-	3	1.5
7.	PC	PC11431	Electrical Simulation Lab	-	-	3	1.5
8.	PC	PC11429	Digital Electronics Lab	-	-	3	1.5
9.	MC	MC114BE	Environmental Science	2	-	-	-
			TOTAL	**17**	**1**	**9**	**20.5**

B.Tech. 4 Year (8 semesters) Regular Programme in Electrical & Electronics Engineering

COURSE STRUCTURE

(Applicable for the Batch admitted from the Academic Year 2018-19 onwards)

III YEAR **I SEMESTER**

S.No.	Group	Sub Code	Subject	L	T	P	Credits
1.	HS	HS115CH	Managerial Economics and Financial Analysis	3	-	-	3
2.	PC	PC115CJ	Power Systems -II	3	1	-	4
3.	PC	PC115BV	Control Systems	3	-	-	3
4.	PE	PE115XX	Professional Elective-1	3	-	-	3
5.	OE	OE115XX	Open Elective-1	3	-	-	3
6.	PC	PC11540	Electrical Measurements and Instrumentation Lab	-	-	3	1.5
7.	PC	PC11535	Control Systems Lab	-	-	3	1.5
8.	HS	HS11542	Employability and Soft Skills Lab	-	-	2	1
			TOTAL	**15**	1	8	**20**

Sub Code	PE-1
PE115CA	Electrical Measurements & Instrumentation
PE115BS	Computer Organization
PE115CL	Special Machines

III YEAR **II SEMESTER**

S.No.	Group	Sub Code	Subject	L	T	P	Credits
1)	HS	HS116CY	Fundamentals of Management	3	-	-	3
2)	PC	PC116DF	Microprocessors and Microcontrollers	3	-	-	3
3)	PC	PC116DH	Power Electronics	3	-	-	3
4)	PE	PE116XX	Professional Elective-2	3	-	-	3
5)	OE	OE116XX	Open Elective-2	3	-	-	3
6)	PC	PC11649	Microprocessors and Microcontrollers Lab	-	-	3	1.5
7)	PC	PC11651	Power Electronics Lab	-	-	3	1.5
8)	PW	PW11652	Seminar	2	-	-	2
			TOTAL	**17**	**-**	**6**	**20**

Sub Code	PE-2
PE116CU	Digital Control Systems
PE116CZ	High Voltage Engineering
PE116CW	Electric & Hybrid Vehicles

B.Tech. 4 Year (8 semesters) Regular Program in Electrical & Electronics Engineering

COURSE STRUCTURE

(Applicable for the Batch admitted from the Academic Year 2018-19 onwards)

IV YEAR **I SEMESTER**

S.No.	Group	Sub Code	Subject	L	T	P	Credits
1.	PC	PC117EM	Power System Protection	3	-	-	3
2.	PC	PC117EL	Power System Analysis	3	-	-	3
3.	PE	PE117XX	Professional Elective-3	3	-	-	3
4.	PE	PE117XX	Professional Elective-4	3	-	-	3
5.	OE	OE117XX	Open Elective-3	3	-	-	3
6.	PC	PC11760	Power Systems Lab	-	-	2	1
7.	PW	PW11758	Mini Project *	-	-	-	2
8.	PW	PW11761	Project Phase - I	1	-	4	3
			TOTAL	**16**	**-**	**6**	**21**

*** Summer between III & IV Years :Mini Project**

Sub Code	PE-3	Sub Code	PE4
PE117DV	Electric Drives	PE117ES	Utilization of Electrical Energy
PE117EN	Programmable Logic Controllers & Their Applications	PE117EG	Line Commutated & Active Rectifiers
PE117DW	Electrical Distribution Systems	PE117EP	Smart Electric Grid

IVYEAR **II SEMESTER**

S.No.	Group	Sub Code	Subject	L	T	P	Credits
1.	HS	HS118FK	Entrepreneurship and Project Management	3	-	-	3
2.	PE	PE118XX	Professional Elective-5	3	-	-	3
3.	PE	PE118XX	Professional Elective-6	3	-	-	3
4.	OE	OE118XX	Open Elective-4	3	-	-	3
5.	PW	PW11863	Project Phase - II	2	-	12	8
			TOTAL	**14**	**-**	**12**	**20**

Sub Code	PE-5	Sub Code	PE-6
PE118FN	Grid Integration of Renewable Energy Systems	PE118FJ	Electrical Machine Modeling & Analysis
PE118FA	Advanced Power Electronics	PE118FH	EHV AC Transmission
PE118FD	AI Techniques in Electrical Engineering	PE118FV	Power Quality and FACTS

LIST OF OPEN ELECTIVES OFFERED BY VARIOUS DEPARTMENTS FOR B.TECH.

S.No	Name of the Department Offering Open Electives	Open Elective-1 (B. Tech III Year I Semester)	Open Elective-2 (B. Tech III Year II Semester)	Open Elective-3 (B.Tech IV Year I Semester)	Open Elective-4 (B.Tech IV Year II Semester)
1	CSE/IT	➢ Fundamentals of Data Structures (OE115KA) ➢ Java Programming (OE115KB)	➢ Operating Systems (OE116KJ) ➢ DataBase Management Systems (OE116KK)	➢ Cyber Security (OE117KR) ➢ Python Programming (OE117KS) ➢ Android Programming (OE117KT)	➢ Principles of Artificial Intelligence (OE118KX) ➢ Cloud Computing (OE118KY)
2	ECE/ETM	➢ Basic Electronics (OE115KC)	➢ Principles of Electronic Communications(OE116KL)	➢ Telecommunication Switching Systems (OE117KU)	➢ Cellular and Mobile Communications (OE118KZ)
3	EEE	➢ Electrical Materials (OE115KD)	➢ Renewable Energy Sources (OE116KM)	➢ Waste Management Techniques and Power Generation (OE117KV)	➢ Robotics (OE118MA)
4	Mechanical	➢ Operations Research (OE115KE)	➢ Operations Research (OE 116KE) ➢ Research Methodology (OE116KN)		
5	H&M	➢ Introduction to Data Analytics (OE115KF) ➢ Intellectual Property Rights (OE115KG)	➢ Behavioral Skills And Professional Communication (OE116KP) ➢ Intellectual Property Rights (OE116KG)	➢ Industrial Management (OE117KW)	➢ Marketing Management (OE118MB)
6	BS	➢ Disaster Management (OE115KH)			➢ Environmental Impact Assessment (OE118MC)

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

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

I Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: BS11AC	**3**	**1**	**-**	**4**

PHYSICS

(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To understand the interaction of light with matter through interference and diffraction.
2. To understand the behavior of a particle quantum mechanically.
3. To understand the importance of dielectric and magnetic materials.
4. To analyze the semiconductors and semiconductor devices.
5. To understand the construction and working principle of different types of lasers and light propagation through optical fiber.

UNIT 1: (~8 Lecture Hours)

Wave optics: Huygens' Principle, superposition of waves, Interference of light by division of wave front and amplitude. Young's double slit experiment, Interference from a thin plane glass plate (reflected light), Newton's rings experiment. Types of diffraction, Fraunhofer diffraction due to single slit and 'N' slits; Diffraction grating experiment.

UNIT 2: (~10 Lecture Hours)

Principles of Quantum mechanics and Band theory of solids: Introduction to Quantum mechanics, Wave particle duality and de-Broglie hypothesis, Davisson–Germer experiment; Uncertainty principle, Time-dependent and time independent Schroedinger equation for wave function, Born interpretation; Free-particle wave function, Particle in 1D box (square well potential) energy values, Expectation values vs position in the box. Density of states and occupation probability; Kronig-Penny model (using Bloch theorem; qualitative), Energy bands in solids, E-k diagram, classification of materials: Metals, Semiconductors and Insulators, Effective mass of an electron.

UNIT 3: (~10 Lecture Hours)

Dielectric and magnetic materials: Dielectric materials: Electric dipole, Dipole moment, Dielectric constant, Polarizability, Electric susceptibility, Displacement vector, electronic, ionic and orientation polarizations, their polarizabilitity expressions, internal field and Clausius-Mossotti(equations only); Piezoelectricity, pyroelectricity and ferroelectricity and their applications; $BaTiO_3$ structure.

Magnetic materials: 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 antiferro and ferri magnetic materials,Superconductivity: Superconductivity phenomenon, Meissner effect, applications of superconductivity.

UNIT 4: (~10 Lecture Hours)

Semiconductors: Intrinsic and extrinsic semiconductor carrier concentrations, intrinsic carrier concentration; Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Diffusion and drift phenomenon(Qualitative), Formation of PN junction, open circuit PN junction, energy diagram of PN junction diode, Direct and indirect bandgaps; Hall-effect, Semiconductor materials of interest for optoelectronic devices (LED, Solar cell).

UNIT 5: (~10 Lecture Hours)

LASERs and Optical Fibers: LASERS: Properties of laser beams: Mono-chromaticity, coherence, directionality and brightness, laser speckles, Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne), solid-state lasers(ruby), Semiconductor Lasers; applications of lasers in science, engineering and medicine.

Fiber Optics: Introduction, light propagation through optical fibre: Total internal reflection, Types of optical fibres: step and graded index fibres, Acceptance angle, Numerical aperture, Attenuation and Bending losses in optical fibres, Applications of optical fibres in Communication, Medicine and as sensors.

Text Books:

1. MN Avadhanulu & PG Kshirsagar, A text book of Engineering Physics, revised Edition of 2014, S Chand.
2. DK Bhattacharya & Poonam Tandon, Engineering Physics, fourth impression 2017, Oxford press.

Reference Books:

1. Eisberg and Resnick, Quantum Physics, 2nd Edition, Wiley.
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., 2007.
3. Material Science by Armugam, Anuradha publications,
4. Physics of the atom by Wehr and Richards. 4th Edition, Narosa.

Online Resources:

1. http://www.cod.edu/people/faculty/cartert/phy2112/slides/Lect29-physical-optics-handout.pdf
2. https://www2.physics.ox.ac.uk/sites/default/files/2012-02-17/optics_lectures_2012_pdf_10837.pdf
3. http://www.iap.uni-jena.de/iapmedia/de/Lecture/Physical+optics1501538400/PO16_Physical+optics+8+Lasers.pdf
4. http://alan.ece.gatech.edu/ECE6451/Lectures/ECE6451L1IntroductionToElectronicMaterials.pdf
5. https://www.colorado.edu/physics/phys3330/phys3330_fa11/Lecture%20notes/semiconductor%20lectures%202011.pdf
6. http://www.seklad69associates.com/seklad69associates.com/EEG_811_files/Semiconductor%20Physics.pdf
7. https://www.youtube.com/watch?v=03j4ZvQCKWY

Course Outcomes:

After completion of the course, the students will be able to

1. Realize the importance of light interaction with matter and its effects of superposition.
2. Understand the quantum mechanical behavior of particles in different field environments.
3. Distinguish materials on the basis of their electric and magnetic behavior and their applications.
4. Estimate the carrier concentration of different types of semiconductors and be able to understand the working of optoelectronic devices.
5. Realize the importance of Lasers in engineering fields.
6. Understand the underlying principles of optical fibers and fiber optics.

I Year B.Tech. EEE I-Semester **L T P C**
Course Code: BS111AB **3 1 - 4**

LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS

(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To learn the concepts of rank of a matrix and applying it to understand the consistency of system of equations.
2. To solve system of linear equations.
3. To study properties of Eigen values and Eigen vectors.
4. To find extreme values for functions of several variables.
5. To find the solutions of first, higher order ODE.
6. To evaluate the double and triple integrals for functions of several variables.

UNIT1: (~8Lecture Hours)
Linear System of Equations: Types of real matrices and complex matrices, rank, echelon form, normal form, consistency and solution of linear systems (homogeneous and Non-homogeneous), LU decomposition method.

UNIT 2: (~8Lecture Hours)
Eigen values and Eigen Vectors: Eigen values, Eigen vectors and their properties.Cayley - Hamilton theorem (without proof), Inverse and powers of a matrix using Cayley - Hamilton theorem, Diagonalization.

UNIT 3: (~12Lecture Hours)
Differential Equations: Linear, Bernoulli's, Exact Differential Equations, Differential Equations Reducible to exact, Orthogonal trajectories.
Linear differential equations of higher order with constant coefficients: Non-homogeneous differential equations with RHS term of the type $e^{ax}, sinax, cosax,$ polynomials in x, $e^{ax}V(x), xV(x),$ Method of variation of parameters, Applications to Electrical circuits.

UNIT 4: (~10Lecture Hours)
Functions of Several Variables: Limit & Continuity (Definitions), Partial derivatives, Chain rules, total derivative, differentiation of implicit functions, Jacobian, functional dependency. Maxima and minima of functions of two variables (with and without constraints) and Lagrange's method of undetermined multipliers.

UNIT 5: (~10 Lecture Hours)

Multiple Integrals: Double and triple integrals, change of variables, Change of order of integration.

Applications: Finding areas as double integral and volumes as triple integrals.

Text Books:

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers.
2. N. P. Bali, Engineering Mathematics, 1st Edition, Lakshmi Publications.

Reference Books:

1. B.V.Ramana, Higher Engineering Mathematics, 1st Edition, Tata McGraw-Hill Publications.
2. E.Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley and Sons Publisher.
3. Srimanta Pal, Subodh C.Bhunia, Engineering Mathematics, 1st Edition, Oxford Higher Education.

Online Resources:

1. http://www.nptelvideos.in/2012/11/mathematics.html
2. http://nptel.ac.in/courses/111106051/

Course Outcomes:

After completion of the course the student will be able to

1. Solve and analyze the solution for the system of equations.
2. Compute the Eigen values and Eigen vectors which come across under linear transformations.
3. Determine the extreme values of functions of two variables with/ without constraints.
4. Find the solutions of ordinary differential equations.
5. Evaluate double and triple integrals.
6. Apply the knowledge of mathematics for real situations.

I Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: ES111AF	**3**	**-**	**-**	**3**

PROGRAMMING FOR PROBLEM SOLVING

(Common to ECE, EEE, CSE, IT & ETE)

Prerequisites:-Nil-

Course Objectives:

1. Learn the fundamentals of computers.
2. Understand the various steps in program development.
3. Learn the syntax and semantics of C programming Language.
4. Learn how to write modular and readable C programs.
5. Learn to write programs using structured programming approach in C to solve problems.

UNIT 1: (~10 Lecture Hours)

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. 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.

UNIT 2: (~10 Lecture Hours)

Repetition statements: (loops)-while, for, do-while statements, Loop examples, other statements related to looping-break, continue.

Arrays: Concepts, using arrays in C, array applications- linear search, binary search and bubble sort, two-dimensional arrays, multidimensional arrays.

Strings: Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions.

UNIT 3: (~9 Lecture Hours)

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.

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.

UNIT 4: (~10 Lecture Hours)
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.

UNIT 5: (~7 Lecture Hours)
Introduction to files, Using files in C, Reading data from files- fscanf(), fgets(), fgetc(), fread(), Writing Data to files- fprintf(), fputs(), fputc(), fwrite(), Detecting the End-of-File, Error Handling functions, Random access to files, Command Line Arguments, preprocessor commands.

Text Books:
1. B.A.Forouzan and R.F.Gilberg, Computer Science: A Strucured Programming Approach Using C, 3rd Edition, Cengage learning.
2. ReemaThareja, Introduction to C Programming, 2ndEdition, Oxford University Press.

Reference Books:
1. Byron Gottfried, Schaum's Outline of Programming with C, 2nd Editon, McGraw-Hill.
2. E.Balaguruswamy, Programming in ANSI C", 7th Edition, Tata McGraw-Hill.
3. B.W.Kernighan & Dennis Ritchie, C Programming Language, 2nd Edition, PHI.

Online Resources:
www.geeksforgeeks.org

Course Outcomes:
After completion of the course, students will be able to
1. Formulate and translate algorithms for arithmetic and logical problems to programs (in C language).
2. Test and execute the programs and correct syntax and logical errors.
3. Implement conditional branching, iteration and recursion.
4. Decompose a problem into functions and synthesize a complete program.
5. Use arrays, pointers and structures to formulate programs.
6. Understand the concepts of files and perform operations on them.

I Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: ES111AE	**1**	**-**	**3**	**2.5**

ENGINEERING GRAPHICS

(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

The course will enable the students

1. To impart skills of drawing instruments and their use to convey exact and complete information of any object.
2. To construct conics and cycloidal curves used for various engineering applications.
3. To impart knowledge about standard principles of orthographic projection of objects.
4. To develop different surfaces of simple solids
5. To differentiate between isometric view and projection and conversion of isometric views to orthographic views vice-versa

UNIT 1: (~4Lectures and 12Practicles)

Introduction to Engineering Graphics : Principles of Engineering Graphics and their significance, Conic Sections-general and special methods, Cycloid, Epi- cycloid and Hypo- Cycloid.

UNIT 2: (~3Lectures and 9Practcles)

Orthographic Projections: Principles of Orthographic Projections – Conventions - Projections of points , straight lines and planes.

UNIT3: (~3Lectures and 9Practcles)

Projection of Solids : Projections of solids in simple position (prisms, pyramids, cylinders and cone), axis inclined to one plane, Axis inclined to both the reference planes, Projection of solids using auxiliary plane method.

UNIT 4: (~3Lectures and 9Practcles)

Development of Surfaces: Basic concepts of development of surfaces, Methods of development – Parallel line development and radial line development, Development of prisms, pyramids, Cylinders and cones.

UNIT 5: (~3Lectures and 9Practcles)

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. Basanth Agrawal, Agrawal C.M., Engineering Graphics, 1st Edition, Tata McGraw Hill, 2012.
2. Bhatt N.D, Elementary Engineering Drawing, Charotar Publishers, 2014.

Reference Books:

1. K .L. Narayana and P.Kannaiah, Engineering Drawing, Scitech, 2010.
2. Venugopal.K., Engineering Drawing and Graphics Plus Autocad, New Age International (P) Ltd., New Delhi, 2010.
3. Gill P.S., Engineering Drawing: Geometrical Drawing, SK Kataria & sons, 2012.
4. Dhananjay A Jolhe, Engineering Drawing, Tata McGraw Hill, 2014.

Online websites / Materials:

www.engineeringdrawing.org, Virtual labs (www.vlab.co.in)

Online courses:

https://onlinecourses.nptel.ac.in

Course Outcomes:

At the end of the course the student will be able to

1. Know and understand the conventions and methods of Engineering Graphics
2. Construct the conics using different methods and cycloidal curves
3. Draw and understand about orthographic projections of points , straight lines and planes
4. Improve visualisation skills in different types of solids
5. Draw and understand about the development of surfaces of various solids
6. Ability to read, understand and interpret engineering drawings

I Year B.Tech. EEE I-Semester **L T P C**
Course Code: ES11104 **1 - 3 2.5**

ENGINEERING WORKSHOP

(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

The course will enable the students:

1. To study of different hand operated Power Tools, uses and their demonstration.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the Engineering field.
4. To develop a right attitude, team working, precision and safety at work place.
5. To study commonly used carpentry joints.
6. To have practical exposure to various welding and joining processes.

I) Trades For Exercises: (12 lectures and 36 Practices)
At least two exercises from each trade:
i) Carpentry ii) Fitting
iii) Tin-Smithy and Development of jobs carried out and Soldering
iv) House-wiring v) Foundry vi) Black smithy

II) Trades for Demonstration and Exposure:(12 Lectures)
i) Plumbing ii) Machine Shop
iii) Wood Turning iv) Welding

Text Books:

1. B.L. Juneja, Workshop Practice, Cengage publications.
2. K. Venugopal , Workshop Manual, Anuradha Publications.

Reference Books:

1. P. Kannaiah & K. L. Narayana , Workshop Manual, 2nd Ed., Scitech publications (I) Pvt. Ltd., Hyderabad,2015
2. K. Venugopal, Dr. V. Prabhu Raja, G. Sreekanjana,Workshop Manual 1st Edition, Anuradha Publications, 2012
3. Hajra Choudury S.K., Hajra Choudury A.K. and Nirjhar Roy S.K., Elements of Workshop Technology, Media Promoters and Publishers private limited, Mumbai, volI 2008 and Vol II 2010

Online Course Material:

www.technologystudent.com

Course Outcomes:

At the end of the course, the student is able to

1. Demonstrate and understand the Engineering workshop safety regulations.
2. Identify and use marking tools, measuring equipment and to work to prescribed accuracies.
3. Know various operations in basic engineering workshops.
4. Understand the practical difficulties encountered in industries during any assembly work.
5. Do simple electrical work through their carrier.
6. Design different prototype in the fittings, carpentry, foundry, black smithy and sheet metal work.

I Year B.Tech. EEE I-Semester **L T P C**
Course Code: BS11102 **- - 3 1.5**

PHYSICS LAB

(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. Students are introduced to handling different instruments to conduct experiments as well as to interpret the data.
2. Students are introduced to experiments as to interpret the data and correlate the same with their understanding of its theory.
3. The objective of the course is to enable students to design experiments and analyses the concepts.

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. Time constant of an R-C circuit (Charging and Discharging).
6. L-C-R circuit.-Resonance & Q-factor (series / Parallel).
7. Magnetic field along the axis of current carrying coil – Stewart and Gees method and to verify Biot-Savart's law.
8. Evaluation of numerical aperture of a given optical fiber.
9. Bending and attenuation losses of fibers.
10. Energy gap of a material of p-n junction.
11. Torsional pendulum – Rigidity modulus.
12. Wavelength of light and determining the LPI of unknown grating of a diffraction grating using laser.
13. V-I characteristics of a solar cell.
14. Quantum dots (Beyond syllabus).

Note: Minimum 12 experiments must be performed.

Text Books:

Manual as prepared for the college by the faculty.

Online Resources:

1. http://www.bsauniv.ac.in/UploadImages/Downloads/PHYSICS-LAB-MANUAL2017-(new-regulation).pdf

2. http://jnec.org/Lab-manuals/FE/Physics.pdf
3. https://www.myphysicslab.com/ (simple simulations)
4. https://www.iist.ac.in/departments/physics-lab
5. https://wci.llnl.gov/simulation

Course Outcomes:

After completion of the course, students will be able to

1. Handle different measuring instruments and asses their accuracy of measurement.
2. Experiment and analyze the results to derive valid conclusions.
3. Compare the experimental results with those introduced in lecture, draw relevant conclusions and substantiate.
4. Develop the experimental skills to design new experiments in engineering.
5. Understand the ethics of working environment and deliver the results in time.
6. Engage themselves in team work and understand each other's strengths.

I Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: ES11105	**-**	**-**	**3**	**1.5**

PROGRAMMING LAB

(Common to ECE, EEE, CSE, IT & ETE)

Prerequisites:-Nil-

Course Objectives:

1. Learn Basic programming concepts.
2. Learn the syntax and semantics of C programming Language.
3. Write programs in C using structured programming approach to solve the problems.

List of Experiments:

Week 1: Familiarization with programming environment Introduction to the working environment, Compiling, running and debugging C Programs, Simple C programs.

Week 2: Simple computational problems using arithmetic expressions

a. Write a C program which reads time required (in Hours and Minutes) to complete two tasks and then print the total time in hours and minutes.
b. Write a C program which reads five students marks in a test and then prints average mark of passed students (Assume that a minimum of 35 is needed to pass) using operators.
c. Assume an Object is thrown upwards with some initial velocity, u (in m/sec). Write a C program to find the maximum height which it can reach. Assume acceleration due to gravity is $9.8m^2$ /sec.
   Hint: Maximum height, $h=u^2/2g$.

Week 3: Problems involving if-then-else structures and switch statement

a. Write a C program to check whether a given number is even or odd using bitwise operator.
b. Write a C program to find the roots of a quadratic equation.
c. Write a C program to carry out the arithmetic operations addition, subtraction, multiplication, division and modulus using switch statement.

Week 4: Iterative problems

a. Write a C program to find whether a given number is Armstrong or not.
b. Write a C program to determine if the given number is a prime number or not.

c. Write a C program to calculate the following Series:
Sum=1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!
d. Write a C program to find the number of even and odd digits in a given number.

Week 5: Applications of 1D Array

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 to search for a Key value in a given list of integers. Use linear search.
c. Write a C program to search for a Key value in a given list of integers. Use binary search.
d. Write a C program to implement Bubble sort method to sort a given list of integers in ascending order.

Week 6: Applications of Strings

a. Write a C program to perform the following
i) To insert a sub-string into a main string at a given position.
ii) To delete n characters from a given position in a string.
b. Write a C program to determine whether the given string is a palindrome or not.
c. Write a C program to replace a substring with another in a given line of text.

Week 7: Applications of 2D arrays and Strings

a. Write a C program that reads two matrices and performs Addition of two matrices.
b. Write a C program that reads two matrices and performs Multiplication of two matrices.
c. Write a C program to Sort Array of Strings.

Week 8: Simple functions

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 function to find the factorial of a positive integer.
c. 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.

Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

d. Write a C program that reads two integers and calls a factorial function to compute ${}^{n}c_{r}$ value.

Week 9: Recursive functions

a. Write a 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 uses a recursive function to generate Pascal's triangle.
d. 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 which calls a recursive function to generate the first n terms of the sequence.

Week 10: Pointers and dynamic memory allocation

a. Write a C program to find the number of times a given word (i.e., a short string) occurs in a sentence.(i.e., a long string).
b. Using pointers, write a function that receives a character string and a character as argument and deletes all occurrences of this character in the string. Function should return the corrected string with no spaces.
c. Write a C program to find the maximum from a set of elements. The number of elements will be decided during the execution of the program.

Week 11: Structures

a. Write a menu-based program in C that uses a set of functions to perform the following Operations:
   i) Reading a Complex number ii) Writing a complex number
   iii)Addition of two complex numbers
   iv) Subtraction of two complex numbers
   v) Multiplication of two complex numbers
   Represent the complex number using a structure
b. Declare a structure to store the following information of an employee: Employee code, Employee name, Salary, Department number, Date of joining (it is itself a structure consisting of day, month and year). Write a C program to store the data of N employees where N is given by the user (Use dynamic memory allocation). Include a Menu that allows user to select any of the following features:

i) Use a function to display the employee information who are drawing the maximum and minimum salary.
ii) Use a function to display the employee records in ascending order according to their date of joining.

Week 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.
c. Write 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.
d. 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.

Text Books:

1. B.A.Forouzan and R.F.Gilberg, Computer Science: A Structured Programming Approach Using C, 3rd Edition, Cengage learning.

Reference Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, 2nd Editon, McGraw-Hill.
2. Yashavant P. Kanetkar, Let Us C, 13th Edition, Bpb Publications.
3. B.W.Kernighan& Dennis Ritchie, C Programming Language, 2nd Edition, PHI.
4. E.Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.

Online Resources

www.geeksforgeeks.org

Course Outcomes:

After completion of the course, students will be able to

1. Compile, debug and test the program.
2. Apply the knowledge in C to write modular, structured programs in solving real world problems.
3. Design programs to solve mathematical and scientific problems.
4. Write structured programs using control structures and functions.
5. Demonstrate usage of pointers and structures.
6. Solve problems using file concepts.

I Year B.Tech.EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: BS112AA	**3**	**1**	**-**	**4**

CHEMISTRY

(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

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.
3. To acquire the knowledge of reaction mechanisms involved in various organic reactions.

UNIT 1: (~8 Lecture Hours)

Molecular Structure and Theories of Bonding: Atomic and molecular orbitals: Linear combination of atomic orbitals (LCAO), molecular orbitals of diatomic molecules. Molecular orbital energy level diagrams of diatomic molecules, N_2, O_2 and F_2. π Molecular orbital diagrams of butadiene, benzene and aromaticity.

Crystal Field Theory (CFT): Salient Features of CFT: Crystal field splitting patterns of transition metalion d-orbitals in tetrahedral, octahedral and square planar complexes. Magnetic properties: Spin only magnetic moments of transition metals of d^2-d^9 configuration in octahedral complexes. Band structure of solids and effect of doping on conductance.

UNIT 2: (~12 Lecture Hours)

Electrochemistry and Corrosion:

Electrochemistry: Conductance: Specific, equivalent and molar conductance and their interrelationship and numerical problems. Electrochemical cell: Electrode potential, standard electrode potential and emf of the cell. Nernst equation, its derivation and applications. Types of electrodes: Standard hydrogen electrode, calomel electrode and glass electrode. Electro chemical series and its applications. Concept of concentration cells: Electrolytic concentration cell and numerical problems. Batteries: Lead acid storage battery and lithium ion battery.

Corrosion: Causes and effects of Corrosion: Theories of chemical and electrochemical corrosion. Mechanism of electrochemical corrosion. Types of corrosion: Galvanic, waterline and pitting corrosion. Factors affecting rate of corrosion. Corrosion control methods: Cathodic

protection-Sacrificial anode and impressed current cathodic methods. Surface coatings: Metallic coatings –hot dipping: galvanizing and tinning. Electroplating: Copper plating and electroless plating - Nickel plating.

UNIT 3: (~8 Lecture Hours)

Periodic Properties and Nanomaterials: Periodic table: Electronic configurations, atomic and ionic sizes, ionizationenergies, electronaffinity and electronegativity. Variations of s,p,d,f orbital energies of atoms in periodic table. Co-ordination numbers and geometries. Hard and soft acids and bases. HSAB rule and its applications.

Nanomaterials: Synthesis: Top down and bottom up approaches. Properties and applications of fullerenes, carbon nanotubes. General applications of nanomaterials.

UNIT 4: (~8 Lecture Hours)

Water and its treatment: Hardness of water: Causes of hardness and types of hardness - temporary and permanent. Expression and units of hardness. Estimation of hardness of water by complexometric method and numerical problems. Potable water and its specifications. Steps involved in treatment of potable water: Disinfection of potable water by chlorination and ozonisation. Boiler troubles: Scales, sludges, priming, foaming and caustic embrittlement. Boiler feed water: Internal treatment by calgon, phosphate and colloidal conditioning and external treatment of Water by Ion exchange process. Desalination of water: Reverse osmosis. Sewage and its treatment: primary, secondary and tertiary treatments.

UNIT 5: (~11 Lecture Hours)

Stereochemistry, Reaction Mechanism and Synthesis of Drug Molecules: Representation of 3-Dimensional structures: Structural and stereo isomers, configurations. Chirality, enantiomers, diastereomers, optical activity and absolute configuration. Conformation analysis of n-butane. Isomerism in transition metal complexes.

Substitution reactions: Nucleophilic substitution reactions, mechanism of SN^1 and SN^2 reactions. Addition reaction: Electrophilic and Nucleophilic addition. Addition of HBr to Propene: Markownikoff and anti Markownikoff additions. Grignard reactions on carbonyl compounds. Elimination reactions: Dehydrohalogenation of alkyl halides-Saytzeff rule. Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and Chromic acid. Reduction reactions: Reduction of carbonyl compounds using $LiAlH_4$ and $NaBH_4$. Synthesis of Drug molecules: Paracetamol and aspirin.

Text Books:

1. P.C Jain and Jain Monika, Engineering Chemistry, 16th Edition, DhanpatRai Publication Company.
2. Morison and Boyd, Organic Chemistry, 7th Edition, Pearson publications.
3. B.Rama Devi, Ch. VenkataRamana Reddy and PrasanthRath, Text Book of Engineering Chemistry, Cengage Learning.

Reference Books:

1. B.H.Mahan University Chemistry, Addison-Wesley Publishing Company.
2. M.J.Sienko and R.A.Plane, Chemistry: Principles and Applications, McGraw Hill International.
3. J.D.Lee, Concise inorganic Chemistry, 5th Edition, Oxford Publication.
4. K.P.CVolhadt and N.E Schore, Organic Chemistry: Structure and Function, 7th Edition, Freeman publications.
5. B.R.Puri and L.R.Sharma and Patani, Principles of Physical Chemistry, 6th Edition, McGraw-Hill Publication.

Online Resources:

1. htttp://www.nptelvideos.in/2017/10/engineering chemistry.html.
2. http://www.nptel.ac.in/engineering chemistry courses.

Course Outcomes:

After completion of the course, students will be able to

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals.
2. Students will gain the basic knowledge of electrochemical procedures related to corrosion and its control.
3. Rationalize periodic properties such as ionization potential, electronegativity and oxidation states.
4. Students can develop and apply the concepts to identify the hardness and boiler troubles of water.
5. List major chemical reactions that are used in the synthesis of drugs.
6. Students can develop and apply the concepts for the solutions of complex engineering problems.

I Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: BS112AG	**3**	**1**	**0**	**4**

NUMERICAL TECHNIQUES AND TRANSFORM CALCULUS

(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites: Vector Algebra.

Course Objectives:

1. To learn an alternative method for analytical methods in mathematical concepts.
2. To apply numerical techniques in solving ordinary differential equations.
3. To study the properties of vector valued functions and differential operators.
4. To attain the knowledge on integrals of vector valued functions.

UNIT 1: (~9 Lecture Hours**)**

Numerical Solutions of Algebraic and Transcendental Equations: Introduction, Bisection Method, Regula-False method, Iteration method and Newton Raphson method. Solving linear system of equations by Gauss-Jacobi and Gauss-Seidel method.

Curve Fitting: Fitting a linear, second degree, exponential curve by method of least squares for the discrete data.

UNIT 2: (~9 Lecture Hours**)**

Numerical integration: Newton-Cote's Quadrature Formula, Trapezoidal Rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ Rule.

Numerical solutions of Ordinary Differential Equations: Solution of ordinary differential equations by Taylor's Series, Picard's method of Successive approximations, Euler's and Modified Euler's methods, Fourth Order Runge-Kutta Method.

UNIT 3: (~10 Lecture Hours**)**

Laplace Transforms: Laplace Transform of Standard functions, First and Second Shifting Theorems, Transforms of derivatives and integrals, Multiplication and Division by 't', Laplace Transform of Periodic Function, Unit Step function, Dirac's Delta function.

Inverse Laplace Transform: Method of Partial Fractions, Convolution theorem (without proof) Applications of Laplace Transforms to Ordinary Differential Equations.

UNIT 4: (~10 Lecture Hours**)**

Vector Differentiation: Scalar and Vector point functions, Gradient,

Divergence, Curl and related properties, Unit Normal Vector, Directional Derivatives and Angle between the surfaces, Laplacian operator, Vector identities.

UNIT 5: (~10 Lecture Hours**)**

Vector Integration - Line Integral-Work Done-Potential function, Area, Surface and Volume Integral.

Vector Integral Theorems: Green's theorem, Stoke's theorem and Gauss's divergence theorem (Without Proofs) and their Verification.

Text Books:

1. Dr. B.S Grewal, Higher Engineering Mathematics , 45th Edition, Khanna Publishers.
2. M.K. Jain,S.R.K.Iyengar and R.K.Jain, Numerical Methods for Science and Engineering Computation, 6th Edition, New Age International Publishers.

Reference Books:

1. R.K.Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, 5th Edition, Narosa Publishers.
2. Murray R Spiegel and Seymour Lipschutz, Vector Analysis, 2nd Edition, Schaums' Outline Series.
3. S.S.Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Pvt. Ltd.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. nptel.ac.in/courses/117101056/17

Course Outcomes:

After completion of the course the student will be able to

1. Find the root of the equation and solution of a system of equations.
2. Fit a curve for the given data.
3. Find the Numerical solutions for a given first order initial value problem.
4. Use Laplace Transform techniques for solving ODE's.
5. Verify the irrotational and solenoidal fields and find the potential function.
6. Evaluate the line, surface and volume integrals and converting them from one to another.

I Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: HS112AJ	**2**	**-**	**-**	**2**

ENGLISH

(Common to EEE, ECE, CSE, IT & ETE)

Course Objectives:

1. To enable the students to understand the importance of English and to develop their basic proficiency in the English language.
2. To train the students to expand their vocabulary and to understand the usage of vocabulary technically and literally.
3. To develop the reading competence of the students through the sub skills of reading.
4. To equip the students with an ability to produce grammatically correct sentences and coherently well-developed paragraphs.
5. To enable the students to develop an appreciation of how the formal elements of language and genre shape meaning and to gain richer understanding of both the text and the cultural context.

UNIT 1: (~7 Lecture Hours)

- **Reading Comprehension**: Short story Cause, Then Cure from **Wise and Otherwise** by Sudha Murthy. Reading Skills: SQW3R Method and guessing and predicting.
- **Vocabulary Building**: Word formation-Root words-Prefixes and Suffixes-Word formation.
- **Remedial Grammar**: Error correction related to: Subject – Verb Agreement, Noun – Pronoun Agreement, and other aspects that are reflected through their writing.
- **Writing Skills**: Sentence structure-Use of Phrases and Clauses in sentences-Sentence Types: Assertive, Declarative, Interrogative, Exclamatory, sentences and Simple, Compound, Complex and Compound - Complex Sentences-Usage of punctuation marks

UNIT 2: (~7 Lecture Hours)

- **Reading Comprehension:** Poem Caged Bird from **A Collection of Hundred Poems** by Maya Angelou. Reading Skills: STEM Technique, vocabulary and intended meaning
- **Vocabulary Building:** Synonyms-Antonyms-Acronyms- Abbreviations
- **Remedial Grammar:** Error Correction related to: Articles and Prepositions,Tenses, Conditional clauses, Tag Questions; and other aspects that are reflected through their writing.

- **Writing Skills:**Principles of Paragraph writing-Cohesive Devices - Creating Coherence - Topic sentence and supporting sentences in a Paragraph - Techniques for writing Precisely - Jumbled sentences

UNIT 3: (~6 Lecture Hours)

- **Reading Comprehension:** General Reading versus Academic Reading Reading Skills**:** Reading for gist, main ideas, specific details
- **Vocabulary Building**: Homophones - Homonyms –Homographs - Words often confused
- **Remedial Grammar**: Error correction related to: Adjectives and Adverbials, Misplaced modifiers, Redundancies; and other aspects that are reflected through their writing.
- **Writing skills**: Precis writing and Summarizing

UNIT 4: (~6 Lecture Hours**)**

- **Reading Comprehension:** Excerpt from **Wings of Fire: An Autobiography** Looking Ahead from APJ Abdul Kalam with Arun Tiwari Abridged version
- **Reading Skills:** Reading for inference, discourse markers, contextualization, summarising
- **Vocabulary Building:** Phrasal verbs – collocations – Idioms
- **Remedial Grammar**: Error corrections related to: Adverbs and Adjectives, Syntactical errors and punctuation marks; and other aspects that are reflected through their writing.
- **Writing Skills**: Letter Writing-Introducing oneself-Statement of Intent -Asking for directions-Seeking / giving information-Apologizing.

UNIT 5: (~6 Lecture Hours**)**

- **Reading Comprehension**: Travelogue The Pamplona Clone: Jallikattu from **Intriguing India-The Historic South** by Hugh and Colleen Gantzer
- **Reading Skills:** Understanding the organization of text, global comprehension.
- **Vocabulary Building:** One-word substitute - General vocabulary versus Academic vocabulary - Literal meaning versus contextual meaning.
- **Remedial Grammar:** Sentence corrections and Editing and proof reading; and other aspects that are reflected through their writing.
- **Writing Skills**: Letter of Application: Covering letter and Resume Writing.

Note: The content prescribed for Reading Comprehension is for Reading Practice only and shall not be given for assessment and evaluation. An unknown Reading Passage shall be given for assessment and evaluation to test the Reading Skills.

Text Books:

1. Vibrant English by Orient Blackswan, 2013.
2. Language and Life: A Skills Approach by Orient Black Swan, 2018.

Reference Books:

1. SudhaMurthy, Wise & Otherwise-A Salute to Life Penguin Books, 2006.
2. Hugh and Colleen Gantzer,Intriguing India-The Historic South NIYOGI Books, 2012.
3. Collection of Poems //www.poetryfoundation.org//
4. MukulChowdhry, Simplified and abridged Wings of Fire: An Autobiography, APJ Abdul Kalam with Arun TiwariUniversity Press Pvt. Ltd., 2004.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_hs01
2. https://nptel.ac.in/courses/109106094/5

Course Outcomes:

After completion of the course the student will be able to

1. Read complex texts actively comprehending the literal and figurative use of language and be able to read in-between the lines.
2. Write grammatically correct sentences and coherently well-developed paragraphs.
3. Apply the reading techniques and comprehend the passages critically.
4. Use appropriate vocabulary in the given context.
5. Appreciate how different genres use language and shape meanings.
6. Articulate clear questions, to provoke critical thinking, and ideas in class discussion to speak confidently in public.

I Year B.Tech. EEE II-Semester	L	T	P	C
Course Code: ES112AD	3	1	-	4

BASIC ELECTRICAL ENGINEERING

(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To introduce the concepts of Basic Electrical parameters.
2. To Analyse basic concepts of AC & DC circuits,
3. To carry out operational analysis of Electrical Machines, Transformers and power converters.

UNIT 1: (~10 Lecture Hours)

Magnetic Circuits and DC Circuits

Magnetic Circuits: Magnetic circuits - MMF, flux, reluctance, Inductance; B-H curve of magnetic materials; Minimization of Hysteresis and Eddy current losses.

DC Circuits: Electrical Circuit elements: R, L and C, voltage and current sources, Star-Delta Transformation, Kirchoff's laws, Nodal and Mesh analysis of simple circuits with dc excitation, Superposition, Thevenin's and Norton's Theorems with independent sources- Simple Problems.

UNIT 2: (~8 Lecture Hours)

AC Circuits

1-ø AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor; Analysis of single- phase ac circuits consisting of R, L, C, RL, RC, RLC combinations, series and parallel resonance.

3-ø AC Circuits: Three phase balanced circuits, voltage and current relations in star and delta connections –Simple Problems.

UNIT 3: (~10 Lecture Hours)

DC Machines and Transformers

Basic Concepts: Faraday's laws of Electromagnetic induction – statically & dynamically induced emf-Lenz's law –Fleming's Right hand rule.

DC Machines: Principle of operation- Construction-working; Types of DC machines-EMF and Torque equation; Torque-Speed characteristics and speed control of separately excited DCMotor-Numerical problems.

Transformers: Ideal and practical transformer, EMF equation, Simple Problems. Equivalent circuit- losses in transformers, Three phase transformer connections (Descriptive treatment only).

UNIT 4 : (~9 Lecture Hours)

AC Machines (Descriptive treatment only)

3ø Induction motors: Principle of Operation, Construction of a Three-Phase Induction Motor; Production of rotating magnetic field; slip-frequency of rotor emf-starting Torque-Torque under running conditions. Torque-Slip characteristics;
1ø Induction motors: Basic concepts of 1øInduction motors: Split-phase Induction Motor;
Synchronous Machines: Principle of Operation of Synchronous Generators.

UNIT 5: (~8 Lecture Hours)
Power Converters & Switchgear (Descriptive treatment only)
Basic Concepts: Basic Semiconductor Devices: Diode, Transistor, SCR;
Power Converters: DC-DC Buck and Boost Converters; Single Phase Inverters- Half & Full , Bridge Configuration (Elementary treatment only).
Switchgear: Introduction to Components of LT (Low Tension) Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB. Types of Wires and Cables, Earthing.

Text Books:
1. T.K.Nagasarkar and M.S.Sukhija, Basic Electrical Engineering , 3rd Edition, Oxford University Press, 2018.
2. V.K Mehta, Rohit Mehta, Principles of Electrical Engineering, S.Chand Publications.

Reference Books:
1. D.P.Kothari and I.J.Nagrath Basic Electrical Engineering, Tata McGraw Hill, 2010.
2. V.DelToro, Electrical Engineering Fundamentals, Prentice Hall India, 1989.
3. D.C.Kulshreshtha, Basic Electrical Engineering, McGraw Hill, 2009.

Course Outcomes:
After completion of this course student should be able to
1. Analyze the basic circuits with application of Network Reduction Techniques and Network Theorems.
2. Understand and analyze magnetic circuits.
3. Analyze the working principles of electrical machines and power converters.
4. Understand the components of low voltage electrical installations.
5. Apply the above conceptual theories to real world Electrical & Electronic problems and applications.
6. Understand and apply the Knowledge of various types of protective systems in real time.

I Year B.Tech.EEE II-Semester **L T P C**
Course Code: BS11207 **- - 2 1**

CHEMISTRY LAB

(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. Chemistry Laboratory curriculum gives the students hands on experience about various scientific and technical aspects.
2. Provide the students with a solid foundation in Chemistry laboratory required to solve engineering problems.
3. To provide an overview of preparation of drugs.

List of Experiments:

Volumetric Analysis:

1. Estimation of hardness of water by Complexometric method using EDTA.
2. Estimation of Ferrous ion by Permanganometry.
3. Estimation of Ferrous ion by Dichrometry.
4. Estimation of Chloride by Argentometry.

Chemical kinetics:

5. Determination of rate constant of acid catalysed hydrolysis of methyl acetate.

Instrumental methods of Analysis:

6. Estimation of HCl by Conductometry.
7. Estimation of HCl and acetic acid in a given mixture by Conductometry.
8. Estimation of HCl by Potentiometry.
9. Estimation of Ferrous by Potentiometry using Potassium dichromate (redox).
10. Estimation of manganese in KMnO4 by Colorimetry.
11. Determination of Viscosity of coconut oil and castor oil.

Synthesis of Drug molecule:

12. Preparation of Aspirin and Paracetamol.

Text Books:

1. B.D.Khosla, A.Gulati and V. Garg, Senior practical physical chemistry (R.C and Co., Delhi).
2. K.K.Sharma and D.S.Sharma, An introduction to practical chemistry (Vikaspublishing, N.Delhi).
3. Y.Bharathikumari and JyotsnaCherukuri, Laboratory manual of engineering chemistry (VGS booklinks).

Reference Books:

1. Vogel's Text book of Quantitative chemical analysis, 5th Edition, 2015.
2. Payal B. Joshi,Experiments in Engineering chemistry, 1st Edition, I.K International Publishing house.

Online Resources:

http://www.nptel videos.in engineering chemistry labexperiments.htm

Course Outcomes:

After the completion of the course, the students will be able to

1. Expected to learn from this laboratory course the concept of error and its analysis.
2. Demonstrate writing skills and can derive valid conclusions.
3. Compare the experimental results with those introduced in lecture, draw relevant conclusions and substantiate.
4. Learn the ability to prepare advanced drug materials.
5. Work on time reactions, thereby can get in depth knowledge on chemical kinetics.
6. The course allows the students to develop and design new experimental skills relevant to the course

I Year B.Tech. EEE II-Semester	L	T	P	C
Course Code: HS11212	-	-	2	1

ENGLISH PROFESSIONAL AND COMMUNICATION SKILLS LAB
(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To introduce the students to the pronunciation symbols and associated sounds of English.
2. To enable the students understand the concept of syllable, word accent and intonation.
3. To enhance the listening skills to understand the nuances of accent, expression, tone and intended meaning to make them understand the difference between stress timed language and syllable timed language.
4. To help the students overcome their inhibitions while speaking English fluently thereby to build their confidence to express their ideas in English.
5. To help the students understand the importance of inter-personal communication, team dynamics and role behavior at the work place.

List of Activities:

Multimedia Lab:

1. **Introduction to the Phonetic symbols and associated sounds of English:** Vowels-Consonants-Diphthongs. Extensive practice through referring to a dictionary.
2. **Word Accent and Pronunciation:** Defining Syllable-Marking Word Accent-Rules of Word Accent-Accent shift versus Suffixes. Extensive practice through List of words, Homographs, Silent letters.
3. **Intonation:** Introduction to Stress and Rhythm-Tonal groups – weak forms-Tone versus context-Falling Tone, Rising Tone, Fall and Rise in Tone. Extensive Practice through listening to different genres- Speech, Poetry, Story, Conversations, Discussions, Talks.
4. **Vocabulary Building:** Practice exercises in vocabulary through word bank and corpus list
5. **Listening skills:** Focused Listening **-** Listening to understand main ideas and specific information and to recognize the opinions, attitudes and purpose of a speaker.

Communication Skills Lab:

1. **Situational Dialogues/ Role Plays:** Formal-Semiformal-informal situations-Punctuation Marks-Tonal variations and voice modulations. Practice in two-way conversations, Discussions, Talks and Interviews.

2. **Communication skills at workplace:** Task based activities for: Intra-personal and Inter-personal communications-Types of communications: oral, written and non-verbal - Group dynamics.
3. **Oral Presentations:** Prepared and Extempore **-** Poster Presentations and JAM [Just A Minute] - Choosing a topic – Developing the content – Choosing appropriate vocabulary - Coherence in presentation - Audibility
4. **Mini Project**: **In campus Survey Report:** Project selection-Team size-Preparing a questionnaire-data collection-data analysis-conclusions and recommendations-Report submission in Manuscript format.
5. **Group Discussions:** Definition of GD-Importance of GD-Stages of GD-Etiquette, Communications, Content, Approach during GD-Individual Roles-Group goals-Types of GD-Expectations and outcomes.

Reference Books:

1. J.Sethi, Kamlesh Sadanand & DV Jindal A Practical Course in English Pronunciation (with two Audio Cassettes) Prentice-Hall of India Pvt.Ltd., New Delhi.
2. T.Balasubramanian, A text book of English Phonetics for Indian Students Macmillan Publications.
3. RK.Bansal and JB.Harrison Spoken English, Orient Longman, 2006.
4. Krishna Mohan & NP Singh, Speaking English Effectively, Macmillan Publications.
5. Business English Communication – Preliminary Cambridge University Press.

Online Resources: NPTEL

Course Outcomes:

After learning the contents of this course, the student will be able to

1. Differentiate between the letters of alphabet and the phonetic symbols.
2. Demonstrate the right pronunciation of the words in English using phonetic transcription and word stress.
3. Speak with the proper intonation, voice modulation and tonal groups.
4. Demonstrate the listening skills through language modules.
5. Speak with clarity and confidence individually and in groups to discuss and present the topics chosen and understand the nuances of team dynamics.
6. Work individually and in teams present the topics and demonstrate their public speaking skills and presentation skills through various aids like posters, PPTs etc.,

I Year B.Tech. EEE II-Semester **L T P C**
Course Code: ES11209 **- - 3 1.5**

BASIC ELECTRICAL ENGINEERING LAB

(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To verify the Network Theorems and understand the usage of common electrical measuring instruments.
2. To understand the basic characteristics of transformers and electrical machines.
3. To get an exposure to the working of power electronic converters.

PART-A (Compulsory)

1. A) Basic Safety Precautions
   B) Study of measuring instruments & elements
      a) Voltmeters, Ammeters, Wattmeters, Multimeters, CRO
      b) Resistors, Inductors & Capacitors.
2. Study of Cut – out sections of
   a) DC Machine b) 3-ø Induction Machine (cage type).
3. Study of Cut – out sections of
   c) Synchronous Machine d) 1-øInduction Machine
4. A) Study of Converters
      a) DC – DC converters b) DC – AC converters
   B) Study of Components of LT switchgear
   a) SFU b) MCB c) ELCB d) MCCB
5. Series resonance. Determination of Resonant frequency & Bandwidth.
6. Parallel resonance. Determination of Resonant frequency & Bandwidth.
7. Verification of Superposition theorem with DC excitation.
8. Verification of Thevenin's & Norton's theorems with DC excitation.

PART-B (Any Two)

1. Load test on a 1-ø transformer. Determination of efficiency.
2. Verification of voltage and current relations in a 3-ø transformer.
3. Measurement of Power in a 3-ø balanced load.
4. Torque v/s speed characteristics of a separately excited DC motor.
5. Torque-slip characteristics of a 3-ø Induction Motor.
6. OCC characteristics of a synchronous generator.

Note: All Experiments from PART-A and any Two Experiments from Part – B are to be conducted

Course Outcomes:

After completion of this course student should be able to

1. Identify & use basic measuring instruments and their usage.
2. Verify different network theorems with dc excitation.
3. Carry out analysis of simple circuits with dc excitation.
4. Analyze bridge rectifiers.
5. Identify power converters.
6. Identify different electrical machines & their characteristics

I Year B.Tech. EEE II-Semester **L T P C**
Course Code: ES11210 **- - 3 1.5**

COMPUTATIONAL MATHEMATICS LAB

(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites: Programming for Problem Solving.

Course Objectives:

1. To illustrate the Flow chart and design an algorithm for the given method.
2. To develop conditional and iterative statements to solve system of linear equations using C language.
3. To inscribe C program that use pointers and functions to find the root of given equation.
4. To implement loops, arrays and strings to solve differential equations in C language.

List of Experiments:

1. Write a C Program to find the addition, subtraction, multiplication of matrices.
2. Write a C Program to find the root of a given equation using Bisection method**.**
3. Write a C Program to find the root of a given equation using method of False position.
4. Write a C Program to find the root of a given equation using Iteration method.
5. Write a C Program to find the root of a given equation using Newton Raphson method.
6. Write a C Program to solve a given system of linear equations using Jacobi's method.
7. Write a C Program to solve a given system of linear equations using Gauss Seidel iteration method.
8. Write a C Program to evaluate definite integral using Trapezoidal rule, Simpson's $1/3^{rd}$ rule and $3/8^{th}$ rule
9. Write a C Program to solve a given differential equation using Taylor's series.
10. Write a C Program to solve a given differential equation using Picard's method.
11. Write a C Program to solve a given differential equation using Euler's method.
12. Write a C Program to solve a given differential equation using Runge-Kutta method.

Text Books:

1. M.K.Jain, S.R.K.Iyengar, and R.K.Jain, Numerical Methods for Scientific and Engineering Computation, 6th Edition, New Age International Publishers.
2. E Balagurusamy, C Programming and Data Structures, 4th Edition, Tata McGraw-Hill Publications.

Reference Books:

1. Pradip Niyogi, Numerical Analysis and Algorithms, 5th Edition, Tata McGraw-Hill Publishers.
2. Yashavant Kanetkar, Let us C-C Programming, 3rd Edition, Schaums' outline series.

Online Resources:

1. http://nptel.ac.in/noc/individual_course.php?id=noc15-cs05
2. http://www.codingalpha.com/numerical-methods-c-program/

Course Outcomes:

After completion of the course the student will be able to

1. Write Flow chart and algorithm for the given program.
2. Have the ability to write C programs to solve specified problems.
3. Find the root of a given equation using C program.
4. Use arrays as part of the software solution.
5. Utilize pointers to efficiently solve problems.
6. Use functions from the portable C library.

II Year B.Tech. EEE I-Semester **L T P C**
Course Code: BS113AK **3 - - 3**

MATHEMATICAL ANALYSIS
(Common to EEE, ECE & ETE)

Prerequisites:-Nil-

Course Objectives:
1. To introduce effective mathematical tools for the solution of partial differential equations.
2. Differentiation and integration of functions of complex variables that are used in various techniques dealing in engineering problems.
3. To develop tool of power series and Fourier series for learning advanced engineering mathematics.

UNIT 1: (~8 Lecture Hours)
Fourier Series: Introduction, Periodic functions, Fourier series of periodic function, Dirichlet's conditions, Even and Odd functions change of interval.

UNIT 2:(~8 Lecture Hours)
First Order Partial Differential Equations: Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions. Lagrange's method to solve first order linear equations and the standard type methods to solve non -linear equations.

UNIT 3:(~12 Lecture Hours)
Analyticity of Complex Functions: Limit, Continuity, Differentiability, Analyticity of Complex Functions and its properties, Cauchy-Riemann equations in Cartesian and Polar coordinates. Harmonicfunctions, Milne-Thompson Method.

UNIT 4: (~10Lecture Hours)
Complex Integration: Simply and Multiply Connected Domains (Definitions), Cauchy's integral theorem, Cauchy's integral formula, Cauchy's Generalized Integral Formula.
Power series: Taylor's theorem, Laurent's theorem (without proofs), classification of singular points.

UNIT5: (~10LectureHours)
Residue Calculus: Calculus of Residues, Residue Theorem (without proof). Evaluation of Real integrals of type

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

Text Books:

1. James Ward Brown & Ruel,V.Churchill, Complex Variables and Applications, 8th Edition, International Edition.
2. Dr.B.S. Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers.

Reference Books:

1. H.S.Kasana, Complex Variables-Theory and Applications, 2nd Edition, Eastern Economy Edition.
2. J.N.Sharma, Functions of A Complex Vaiables, 49th Edition, Krishna Prakashan Publishers.
3. Ravish R Singh and Mukhul Bhatt, Engineering Mathematics, A Tutorial Approach, 2nd Edition, McGraw Hill Education.

Online Resources:

1. onlinelibrary.wiley.com
2. nptel.ac.in/courses/111107056

Course Outcomes:

After completion of the course the student will be able to

1. Express an infinite series representation of periodic function in terms of the trigonometric sine and cosine functions.
2. Solve first order partial differential equations.
3. Understand about analyticity of complex functions and its properties.
4. ntegrate a complex valued function in a given region.
5. Expand a complex function in a given region of convergence using Taylor's and Laurent's series.
6. Applying knowledge of complex integrals for evaluation of real integrals.

II Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: ES113AM	**3**	**-**	**-**	**3**

CIRCUITS THEORY

Prerequisites: Basic Electrical Engineering

Course Objectives:

1. To introduce the basic concepts of circuit analysis, which is the foundation for all subjects of the electrical engineering.
2. To introduce basic analysis of circuits which includes three phase circuits, magnetic circuits, theorems, transient analysis, network parameters, filters and network topology.
3. To introduce basic analysis of various types of filters.

UNIT 1: (~10 Lecture Hours)

Faraday's laws of electromagnetic Induction: Self and Mutual Inductances-Types of induced EMFs-Series and Parallel Magnetic Circuits-Dot Convention-Coupled circuits-coefficient of coupling – Comparison of electric and magnetic circuits-problems.

Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem and Millman's Theorem with DC and AC Excitation.

UNIT 2: (~8 Lecture Hours)

Network Topology: Definitions-Graph, Tree, Basic Cut-set and Basic Tie-set matrices for planar networks-Loop and Nodal methods of analysis of Networks with dependent & independent voltage and current sources - Duality & Dual networks.

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 3: (~9 Lecture Hours)

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

UNIT 4: (~10 Lecture Hours)

Network functions: Driving Point and Transfer Functions-Poles and Zeros-necessary conditions for Driving Point functions and Transfer functions.

Two Port Network parameters: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

UNIT 5 : (~8 Lecture Hours)

Locus diagrams: Series and parallel combination of R-L, R-C, R-L-C circuits.

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. M. E.Van Valkenburg, T.S. Rathore, Network Analysis, Pearson Education, 3rd Edition, 2019.
2. N. C. Jagan & C. Lakshminarayana, Network Theory, B.S Publications, 2014.
3. W. H. Hayt Jr, J. E. Kemmerly, Engineering Circuit Analysis, McGraw Hill Education, 8th Edition, 2013.

Reference Books:

1. C. K. Alexander and M. N. O. Sadiku, Electric Circuits, McGraw Hill Education, 6th Edition, 2019.
2. A. Chakrabarthy, Circuit Theory – Analysis & Synthesis, Dhanpat Rai, 7th Edition, 2018.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Analyze magnetic circuits.
2. Apply network theorems for the analysis of electrical circuits.
3. Obtain the transient and steady-state response of electrical circuits.
4. Analyze two-port circuit behavior.
5. Construct and analyze locus diagrams for RL, RC and RLC networks.
6. Apply the concept of different types of basic filters to construct composite filters.

II Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC113AR	**3**	**-**	**-**	**3**

ANALOG ELECTRONICS

Prerequisites: Physics

Course Objectives:

1. To understand the characteristics of Diodes, Transistors and Op-Amp.
2. To analyze various configurations of BJT and MOSFET.
3. To Design various biasing and amplifier circuits.
4. To explore various applications of Diodes and Op-Amp.

UNIT 1: (~ 8 lecture Hours)

Diodes: PN Junction Diode V-I characteristics, Diode current equation, piecewise linear characteristics of PN diode, Zener Diode.

Applications of P-N Junction Diode: Basic operation of half wave and full wave rectifiers without filters, clippers (Series and Shunt Clippers, Clipping at two independent levels), Clamping operation.

UNIT 2: (~10 lecture Hours)

Bipolar Junction Tranistor (BJT): Construction, Principle of Operation, Symbol, BJT as a switch, BJT as an Amplifier: Common Emitter, Common Base and Common Collector configurations.

Transistor Biasing: Operating point, DC & AC load lines, Biasing - Voltage divider bias, Bias stability.

Small Signal Low Frequency Model of BJT: BJT modeling, Hybrid model, Determination of h-parameters from transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters, direct coupled multistage amplifiers.

UNIT 3: (~9 lecture Hours)

Mosfet: MOSFET Construction and Principle of operation, Symbol, V-I Characteristics (Enhancement and depletion mode), Small Signal Model and Biasing MOSFET, Common source, Common Drain, Common Gate amplifiers: Small signal equivalent circuits-gain, input and output impedances, transconductance.

UNIT4: (~8 lecture Hours)

Power Amplifiers: Class A and Class B power Amplifiers. Op-Amp: Internal Structure of an Op-Amp, ideal Op-Amp, non-idealities in an Op-Amp.

UNIT 5: (~10 lecture Hours)

Linear Applications of Op-Amp: Inverting and Non-inverting amplifiers, differential Amplifier, integrator, active filters (LPF and HPF), P,PI and PID controllers and lead/lag compensator using an Op-Amp, General Purpose Voltage regulator IC 723, oscillators (Wein bridge and Phase Shift)

Non-Linear Applications of Op-Amp: Schmitt Trigger, Zero crossing Detector, Square wave and triangular wave generators, Monostable multivibrator.

Text Books:

1. J. Millman and A. Grabel, Microelectronics, 2nd Edition, McGraw Hill, 1988.
2. A.S. Sedra and K.C. Smith, Microelectronic Circuits, 4th Edition, Saunder's College11 Publishing.
3. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, PHI, 2003.

References:

1. D. Roy Chowdhury, Linear Integrated Circuits, 2nd Edition, New Age International (p) Ltd, 2003.
2. J. Millman, H. TaubandMothiki S. PrakashRao, Pulse, Digital and Switching Waveforms, 2nd Edition, McGraw Hill, 2008.
3. Curtis D.Johnson, Process Control Instrumentation Technology, 8th Edition, Pearson New International.

Online Resources:

1. http://www.radio-electronics.com
2. https://users.encs.concordia.ca/~rabinr
3. https://www.elprocus.com

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the fundamental behaviour of various diodes, transistors and OP-AMP.
2. Illustrate the construction, operation and characteristics of BJT and MOSFET.
3. Analyze the various amplifier circuits using small signal hybrid model.
4. Classify various MOSFET configurations.
5. Distinguish between various power amplifiers.
6. Apply the knowledge of Diodes, OP-AMPs in designing circuits.

II Year B.Tech.EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC113AU	**3**	**1**	**-**	**4**

ELECTRICAL MACHINES-I

Prerequisites: Basic Electrical Engineering

Course Objectives:

1. To introduce the concepts of magnetic circuits.
2. To impart knowledge on working and applications of DC machines.
3. To gain an understanding on analysis and performance of DC Machines and Transformers.

Unit 1: (~8 Lecture Hours)

Electromagnetic force and torque: Linear and Nonlinear magnetic circuits; Energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency.

Unit 2: (~10 Lecture Hours)

DC Machines-Principle & Operation: Principle of operation of Generator and Motor-construction of DC machine-Function of commutator-armature winding-EMF equation-Torque equation-Armature reaction-Cross magnetizing and de-magnetizing AT/pole-compensating winding-commutation-reactance voltage-methods ofimproving commutation.

Unit 3: (~10 Lecture Hours)

DC Machines-Characteristics & Testing: Armature circuit equation for motoring and generation, Types of field excitations -separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control methods. Losses, Efficiency-Testing of DC machines - direct, Indirect and regenerative tests, field's test, separation of losses test, retardation test, Hopkinson's Test.

Unit 4: (~10 Lecture Hours)

1-ø Transformers: Principle of operation, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit

tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses; Autotransformers - construction, principle of operation applications - comparison with two winding transformer.

Unit 5: (~8 Lecture Hours)

3-ø Transformers: Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of transformers, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, Open delta connection, three-phase to six-phase conversion, Tap-changing transformers -No-load and on-load tap-changing of transformers, Three-winding transformers.

Text Books:

1. P. S. Bimbhra, Electrical Machinery, 7th Edition, Khanna Publishers, 2011.
2. J.B. GuptaTheory & Performance of Electrical Machines, S.K. Kataria & Sons, Edition, 2015.
3. I. J. Nagrath and D.P. Kothari, Electric Machines, 5th Edition, McGraw Hill Education, 2017.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, Electric Machinery, McGraw Hill Education, 6th Edition, 2005.
2. M. G. Say, Performance and design of AC machines, CBS Publishers, 2002.
3. A. S. Langsdorf, Theory of Alternating current machinery, 2nd Edition, McGraw Hill Education, 1984.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of magnetic circuits.
2. Understand the operation and control of dc machines.
3. Analyze the differences in operation of different dc machine configurations.
4. Analyze single phase and three phase transformers circuits.
5. Identify proper type of motors suitable for a given application.
6. Extend the concepts of single phase transformer in fabricating and analyzing various configurations of three phase transformer.

II Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC113AV	**3**	**-**	**-**	**3**

ELECTRO MAGNETIC FIELDS

Prerequisites: Physics

Course Objectives:

1. To understand and apply the concepts of electric fields and magnetic fields.
2. To gain understanding of Maxwell's equations for both static and time varying fields.
3. To introduce the concepts of plane wave motion and Electromagnetic Interference.

UNIT 1: (~12 Lecture Hours)
Static Electric Fields: Review of Vector Algebra, co-ordinate Systems, Unit Vectors, Scalar & Vector Products, Differential Lengths, Differential Surfaces & Differential Volumes. Coulomb's Law, Electric Field Intensity (EFI), EFI due to Point, Line, Surface &Volume Charges-Gauss Law & its Applications-Divergence- Maxwell's First Equation - Divergence Theorem –Electric Potential-Maxwell's Second Equation–Potential Gradient, Electric Dipole, Electrostatic Energy & Energy Density.

UNIT 2: (~8 Lecture Hours)
Conductors, Dielectrics & Capacitance: Behavior of Conductors in an Electric Field- Current-Current Density-Continuity Equation-Point Form of Ohm's Law, Dielectrics-Polarization-Dielectric Constant-Boundary Conditions, Capacitance-Capacitance of a Two Wire Line, Poisson's & Laplace's Equations-Solution & Applications of Laplace's Equation.

UNIT 3:(~9 Lecture Hours)
Static Magnetic Fields: Biot-Savart's Law-Magnetic Field Intensity (MFI)-MFI due to Straight, Circular & Solenoidal Current Carrying conductors, Ampere's Circuital Law & its Applications- Curl-Maxwell's Third Equation-Stoke'sTheorem, Magnetic flux- Magnetic Flux Density-Maxwell's Fourth Equation, Scalar and Vector Magnetic Potentials & their Properties.

UNIT 4: (~8 Lecture Hours)
Forces in Magnetic Fields & Inductance: Force on a Moving Charge-Lorentz's Force Equation-Force on a Differential Current Element-Force between Two Straight Long Parallel Current Carrying Conductors, Nature of Magnetic Materials-Magnetic Dipole-Magnetization and Relative

Permeability, Magnetic Circuits-Self & Mutual Inductances, Magnetic Energy Stored and Energy Density.

Unit 5: (~9 Lecture Hours)

Time Varying Fields & Electro Magnetic Interference: Faraday's Laws of Electromagnetic Induction –Statically & Dynamically Induced EMF, Displacement Current, Modification of Maxwell's Equations for Time Varying Fields. Uniform Plane Waves-Maxwell's Equations in Phasor form (Qualitative Treatment Only),Poynting Theorem & Poynting Vector. Introduction to Electro Magnetic Interference and Electro Magnetic Compatibility (EMI & EMC)-Sources and Characteristics of EMI (Elementary Treatment Only).

Text Books:

1. William H Hayt, John A Buck, Akhtar, Engineering Electromagnetics, 8th Edition, McGraw Hill, 2017.
2. Mathew N O. Sadiku, S.V. Kulkarni, Electromagnetic Fields, 6th Edition, Oxford University Press, 2015.

Reference Books:

1. D J Griffiths, Introduction to Electro Dynamics, 4th Edition, Pearson Education, 2015.
2. Ashutosh Pramanik, Electromagnetism-Theory and Applications, 2nd Edition, Prentice Hall of India Pvt. Ltd, 2009.
3. William H Hayt & John A Buck, Electromagnetics-Problems and Solutions, McGraw Hill Education, 2017.

Course Outcomes:

1. Apply the principles of Vector Algebra to understand the basic laws of electric and magnetic fields.
2. Distinguish between the properties of conductors & Dielectrics under the influence of both electric and magnetic fields.
3. Formulate and Solve typical problems w.r.t. electrostatics and magneto statics in different media.
4. Analyze/interpret various field equations in both point form and integral form.
5. Analyze the problems related to both static and time varying fields by using Maxwell's Equations.
6. Extend the concepts of field theory to realize plane wave motion and also acquire the concepts of Electromagnetic Interference.

II Year B.Tech. EEE I-Semester **L T P C**
Course Code: ES11315 **- - 3 1.5**

CIRCUITS LAB

Prerequisites: Basic Electrical Engineering

Course Objectives:

1. To Construct and verify various electrical circuits applying network theorems(AC).
2. To Learn different transient responses for various electrical circuits like RL, RC and RLC.
3. To Understand the concepts of Three phase, network topology, magnetic circuits and filters.
4. To Evaluate the various electrical and electronic parameters using two –port networks.

List of Experiments:

1. Separation of Self and Mutual inductance in a Coupled Circuit. Determination of Coefficient of Coupling.
2. Determination of form factor for non-sinusoidal waveform.
3. Verification of Thevenin's and Norton's Theorems. (with A.C. Excitation)
4. Verification of Superposition and Maximum Power Transfer Theorems. (with A.C. Excitation)
5. Measurement of Active Power for Star and Delta connected balanced loads using two-wattmeter method.
6. Time response of first order RC / RL network for periodic non – sinusoidal inputs –Time constant and Steady state error determination.
7. Two port network parameters-Z-Y parameters, Analytical verification.
8. Two port network parameters-Transmission Line & Hybrid parameters, Analytical verification.

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

9. Locus Diagrams of RL and RC Series Circuits.
10. Verification of KCL & KVL.
11. DC Transient response of R-L-C circuit with variation of R parameter.
12. Frequency response of R-L, R-C circuits, Low Pass and High Pass Filters.

Course Outcomes:

After completion of this course student should be able to

1. Analyze various theorems for linear AC circuits.
2. Evaluate two port network parameters for various electrical circuits.
3. Analyze the transient and steady state behavior of AC circuits.
4. Understand the concept of three phase balanced and magnetic circuits.
5. Design passive filters and analyze different network topologies.
6. Determine self and mutual inductances and coefficient of coupling through the knowledge of “Magnetic Circuits”

II Year B.Tech EEE I-Semester **L T P C**
Course Code: PC11318 **- - 3 1.5**

ANALOG ELECTRONICS LAB

Prerequisites:-Nil-

Course Objectives:

1. To familiarize with various circuit components, Display devices.
2. To understand the characteristics of various semiconductor devices.
3. To plot the frequency response of various Amplifiers.
4. To verify practically different applications of Op-Amp.

List of Experiments:

1. V-I characteristics of PN junction Diode under Forward and Reverse Bias.
2. HWR and FWR without filter.
3. Input and output Characteristics of a BJT in CE configuration and derivation of h-parameters from Characteristics.
4. Input and output Characteristics of a BJT in CB configuration and derivation of h-parameters from Characteristics.
5. Drain and Transfer characteristics of MOSFET.
6. Frequency response of CE Amplifier.
7. Frequency response of CC Amplifier.
8. Inverting Amplifier and Non-Inverting Amplifier using Op-amp 741.
9. Integrator using using Op-amp 741.
10. Wein Bridge Oscillator using Op-amp 741.
11. Square wave and Triangular wave generator using Op-amp 741.
12. Schmitt Trigger using Op-amp 741.

Online Resources:

1. https://circuitdigest.com/electronic-circuits
2. https://www.elprocus.com/semiconductor-devices-types-and-applications/

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Illustrate the utility of various semiconductor devices, passive elements, circuit behavior and parameters to be estimated.
2. Identify specifications, choice of device and equipment required; develop of the circuit and measurement of various diodes and transistor circuit characteristics.

3. Set up different types of rectifiers, circuits to interpret the different applications of op-Amps.
4. Design, develop and test BJT and FET amplifier circuits and estimate the relevant parameters.
5. Compare the experimental results with theoretical results, explain the parameters involved and justify the results obtained.
6. Interpret the results for further development of circuit features and subsequent applications.

II Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC11321	**-**	**-**	**3**	**1.5**

ELECTRICAL MACHINES - I LAB

Prerequisites: Basic Electrical Engineering

Course Objectives:

1. To gain thorough knowledge about operation and the performance of DC Machines.
2. To understand Different starting methods of DC Machines.
3. To draw the performance characteristics of DC Machines for different load conditions.

List of Experiments

PART-A (Compulsory)

1. Magnetization Characteristics of DC Shunt Generator. Determination of its critical field resistance and critical speed.
2. Brake test on DC shunt motor.
3. Load test on DC Compound Generator.
4. Brake test on DC Compound motor.
5. Load test on DC Shunt Generator.
6. Load Test on DC Series Generator.
7. Hopkinson's Test on DC Shunt Machines.
8. Swinburne's Test on DC Machine.

PART-B (Any two from the following list)

1. Separation of No Load losses in DC Shunt Motor.
2. Retardation test on DC shunt motor.
3. Speed control of DC shunt motor.
4. Field's Test on DC Series machines.

Course outcomes:

After completion of this course student should be able to:

1. Analyze the characteristics of DC machines.
2. Carry out various tests to assess the performance of DC Machines
3. Understand different starting methods of DC Machines.
4. Know conceptual things to implement in real time applications.
5. Choose suitable DC motor for a specific application.
6. Identify the relevant speed control technique based on the application.

II Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: MC11317	**2**	**-**	**-**	**-**

GENDER SENSITIZATION

(Mandatory Course)
(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites:-Nil-

Course Objectives:

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

UNIT 1: (~6 Lecture Hours)
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 2: (~6 Lecture Hours)
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 3: (~7 Lecture Hours)
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 4: (~7 Lecture Hours)
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 5 : (~6 Lecture Hours)
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.

Text Books:
All the five Units in the Textbook, **Towards a World of Equals: A Bilingual Textbook on Gender**, written by A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, GoguShyamala, DeepaSreenivas and Susie Tharu and published by **Telugu Akademi**, **Hyderabad**, Telangana State in the year 2015.

Reference Books:
1. Menon and Nivedita, Seeing like a Feminist, Zubaan-Penguin Books, New Delhi, 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/

Online Resources:
NPTEL:http://textofvideo.nptel.ac.in/110105080/lec20.pdf

Course Outcomes:
Students will have developed a better understanding of important issues related to gender in contemporary India.
1. 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.

2. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
3. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Men and women students and professionals will be better equipped to work and live together as equals.
5. Students will develop a sense of appreciation of women in all walks of life.
6. 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.

II Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: BS114BB	**3**	**-**	**-**	**3**

TRANSFORM TECHNIQUES AND APPLICATIONS (TTA)

Prerequisites:-Nil-

Course Objectives:

1. To learn the Random Variables and Probability theoretical distributions.
2. To study the different types of Transforms.
3. To understand the different types of elementary signals.
4. Applications of Transforms to Signals and Systems.

UNIT 1: (~10 Lecture Hours)

Fourier Transforms: Fourier integral theorem (without proof), Fourier transform, Fourier sine and cosine transforms Properties, Transforms of simple functions, Convolution theorem, Parseval'sidentity,Finite Fourier Transforms.

UNIT 2: (~8 Lecture Hours)

Z-transforms: Elementary properties, Inverse Z transform (using partial fractions), Convolution theorem, Finite Differences, Properties, Formation of difference equations, Solution of difference equations using Z- transform.

UNIT 3: (~12 Lecture Hours)

Random Variables: Introduction to Random variables, Discrete Random Variable, Continuous Random Variable, Probability Distribution function, Probability density function.

Probability Theory Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution.

UNIT 4: (~8 Lecture Hours)

Elementary Signals: Unit Step Function, Unit Ramp Function, Unit Parabolic Function, Unit Impulse Function, Sinusoidal Signal, Real Exponential Signal, Rectangular Pulse Function, Triangular Pulse Function.Classification of Signals - Continuous Time and Discrete Time Signals, Periodic and Non Periodic Signals, Casual and Non Casual Signals, Even and Odd Signals.Classification of Systems: Continuous Time and Discrete Time Systems, Casual and Non Casual Systems, Linear and Non-Linear Systems, Time Varying Systems, Stable and Unstable Systems.

UNIT 5: (~10Lecture Hours)

Applications of Transforms to Signals and Systems: Fourier Transform Applications to Periodic Signals, Discrete Time LTI Systems, Stability of Discrete LTI Systems, Relation Between Z and Laplace Transform.

Text Books:

1. Dr. B. S.Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers.
2. A . Anand Kumar, Text Book of Signals and Systems, 3rd Edition, PHI Learning Publications.

Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley and Sons.
2. Srimanta Pal, Subodh C. Bhunia, Engineering Mathematics, 1st Edition, Oxford Higher Education.
3. Hwei P Hsu, Signals and Systems, 2nd Edition, Tata McGraw-Hill Publications.

Online Resources:

https://onlinecourses.nptel.ac.in/noc18ma12.

Course Outcomes:

After completion of the course the student will be able to

1. Understand the theory of probability distributions.
2. Determine the Fourier Transform of a given function.
3. Evaluate the Z transform of the given function.
4. Identify Different Types of Elementary Signals.
5. Apply the concepts of Fourier transforms to Signals and Systems.
6. Use the concepts of Z transforms to Signals and Systems.

II Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: ES114BC	**3**	**-**	**-**	**3**

MATERIAL SCIENCE

(Common to EEE, ECE & ETE)

Prerequisites: Physics

Course objectives: The objective of this course will be to give the students

1. Basic introduction to the different classes of materials relevant to Engineering in general.
2. The intent of this course is to relate the underlying molecular structure of the materials to their physical and chemical properties
3. Classify the materials and their applications.
4. Know the environmental and social issues in material science.

UNIT 1: (~10 Lecture Hours)

Introduction: classification of engineering materials, levels of structure, structure property relationships in materials, Atomic Bonding-Ionic, Covalent, metallic Bonding, Hydrogen and Vander Waal's bonding. Crystal Structure: -Basic definitions, Space lattice, Crystal structures of metals-Simple cubic structure, Body centered cubic structure, Face centered cubic structure, Hexagonal closely packed structures, packing of atoms inside solids. Classification of polymers, structure of long chain polymers, structure of silica and silicates.

UNIT 2: (~10 Lecture Hours)

Types and applications of materials: Ferrous alloys, Non-ferrous alloys, Glasses, Ceramics, Plastics, Fibres.

Mechanical properties of metals: Yield strength, tensile strength and ductility of materials, tensile stress- strain curve. Plastic deformation-Plastic deformation by slip, Deformation by twinning, types of twins, Necking.

Creep: Mechanism of Creep and Creep resistant materials. Fatigue- Stress cycle, Fatigue failure, mechanism of fatigue failure.

UNIT 3: (~9 Lecture Hours)

Thermal properties of metals: Heat capacity, thermal expansion, thermal conductivity, thermal stress, thermal fatigue, thermal shock.

Electrical properties of metals: Electrical conductivity, electronics and ionic conduction, energy band structures in solids, electrical resistivity of metals, electrical characteristics of alloys used for commercial purposes.

UNIT 4: (~9 Lecture Hours)

Magnetic materials: Terminology and classification, magnetic moments

due to electron spin, ferromagnetism and related phenomena, soft magnetic materials and hard magnetic materials.

Dielectric materials: Polarization, temperature and frequency effects, electric breakdown, ferroelectric materials.

Insulating materials: Types and Properties

UNIT 5: (~8 Lecture Hours)

SPV Materials, mono crystalline and poly crystalline materials, amorphous materials

Nano materials:Classification of nano materials, processing of nano materials and properties of nano materials-mechanical, electrical, magnetic and other properties of materials.

Material selection: Economic consideration, Environmental and societal considerations. Issues in material science - Recycling issues in material science.

Text Books:

1. V. Raghavan Material Science and Engineering: A first course, 6th Edition prentice Hall India, 2016.
2. S.L. Kakani, Amit kakani, Material science, New age international (p) limited publishers, 2006.
3. William D.Callister, David G.Rethwisch, Material Science and Engineering : An introduction, 7th Edition, Wiley publisher.

Reference books:

1. I.P.Sing, Subhash Chander, Rajesh K.Prasad, Material science & Engineering, Jain brothers, 2014.
2. William F.Smith, Javad Hastami, Ravi Prakash, Material Science and Engineering, McGraw Hill education, 5th Edition, 2014.
3. M. Armugam, Material Science, Anuradha publications.

Online course material:

https://freevideolectures.com

Online courses:

https://onlinecourses.nptel.ac.in

Course outcomes:

At the end of the course students should be able to

1. Indentify crystal structure for various materials
2. Understand the mechanical properties of metals
3. Classify the metals and their applications
4. Assess the thermal and electrical properties of metals
5. Classify the Nonmaterial and properties
6. Analyse the economic, environmental and social issues in material science

II Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC114BK	**3**	**-**	**-**	**3**

DIGITAL ELECTRONICS

(Common to EEE, CSE, IT)

Prerequisites:-Nil-

Course Objectives:

1. To understand common forms of number representation in digital electronic circuits and convert between different representations.
2. To design combinational logic circuits.
3. To design sequential logic circuits.
4. To understand logic families and data converters

UNIT 1: (~8 Lecture Hours)

Number Systems: Review of number systems, Complements of Numbers, Codes - Binary Codes, Binary Coded Decimal Code and its Properties.

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

UNIT 2: (~10 Lecture Hours)

Minimization of Combinational Circuits: Introduction, The minimization of switching function using theorem, The Karnaugh Map Method-Up to Six Variable Maps, Don't Care Map Entries, Tabular Method.

Design of Combinational Logic: Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Carry Look Ahead Adder, Comparators, Multiplexers, Demultiplexers, Decoders, Encoders and Code Converters, Decoders for Display Drivers, PLD's: PROM, PLA, PAL, Realization of circuits using PLD's

UNIT 3: (~8 Lecture Hours)

Sequential Machines Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, Latches: SR, JK, Race Around Condition in JK, Flip Flops: 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.

UNIT 4: (~8 Lecture Hours)

Registers and Counters: Shift Registers, Shift Register Configuration, Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Asynchronous and Synchronous Counters, mod-n Counters.

UNIT 5: (~10 Lecture Hours)

Logic Families: Introduction, Characteristics of Digital ICs, Transistor Transistor Logic, Emitter Coupled Logic, MOS Logic, CMOS Logic, Interfacing ECL and TTL, Interfacing CMOS and TTL, Interfacing CMOS and ECL.

A/D and D/A Converters: Digital to Analog convertors: Weighted resistor/convertor, R-2R Ladder D/A converter, specifications for D/Aconverters, examples of D/Aconverter ICs, sample and hold circuit, Analog to Digital convertors: Quantization and encoding, parallel comparator, A/D converter, successive approximation A/D converter, Counting A/D comparator, A/D converter, Successive approximation A/D converter, Counting A/D converter, dual slope A/D Converter, A/D Converter using voltage to frequency and voltage to time conversion, Specifications of A/D Converters, Example of A/D Convertor ICs.

Text Books :

1. Morris Mano, Digital Design, 5th Edition, Pearson.
2. R.P. Jain, Modern Digital Electronics, 4th Edition, Tata McGraw Hill.
3. ZviKohavi&Niraj K.Jha, Switching and Finite Automata Theory, 3rd Edition, Cambridge.

References:

1. W.H. Gothmann, Digital Electronics- An introduction to theory and practice, 2nd Edition, PHI.
2. AAnand Kumar, Switching Theory and Logic Design, 3rd Edition, PHI.

Online Resources:

1. https://courses.cs.washington.edu/courses/cse370/08wi/pdfs/lectures/04-Logic%20gates.pdf
2. http://www.cs.utoronto.ca/~sengels/csc258/lectures/Gates_1up.pdf
3. http://www.site.uottawa.ca/~petriu/Digital-Logic.pdf
4. https://www.slideshare.net/wewemahir/adc-dac-54832376
5. www.cse.cuhk.edu.hk/~khwong/www2/ceng4480/ceng4480_A3.pp
6. http://www.electronics-tutorial.net/digital-logic-families/

7. http://digitalbyte.weebly.com/logic-families.html
8. https://www.tutorialspoint.com/digital_circuits/digital_circuits_shift_registers.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Recall fundamental concepts and techniques involved in the design of digital circuits.
2. Comprehend the concepts to design basic combinational and sequential circuits.
3. Demonstrate building of various designs using basic digital blocks.
4. Verify the digital designs for required functionality.
5. Interface ICs from different logic families.
6. Analyse the design and performance of different Data Converters.

II Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC114BL	**3**	**1**	**-**	**4**

ELECTRICAL MACHINES-II

Prerequisites: Basic Electrical Engineering, Circuits Theory and Electrical Machines-I

Course Objectives:

1. To understand the construction and operating characteristics of Induction motor, synchronous machines and fractional KW machines.
2. To Analyse the Induction motor and Synchronous machine performance for different loading conditions, as well operating in parallel.
3. To know Different starting methods of Induction motor, Synchronous motor and Special motors.
4. To identify different speed control methods and various tests to assess the performance of AC Machines.

UNIT 1: (~10 Lecture Hours)

Poly-Phase Induction Motors: Poly-phase Induction motors-construction 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 pf at standstill and during operation. 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-double cage and deep bar rotors-equipment circuit –phasor diagram-crawing and cogging.

UNIT 2: (~10 Lecture Hours)

Circle Diagram & Speed control of Induction Motors:

Circle Diagram: No load and blocked rotor tests –predetermination of performance-methods of starting and starting current and torque calculations.

Speed control: Change of frequency; change of poles and methods of consequent poles; cascade connection; Injection of EMF into rotor circuit (Qualitative treatment only)-induction generator-principle of operation.

UNIT 3: (~10 Lecture Hours)

Synchronous Generators: Constructional features of cylindrical rotor & Salient pole machines, armature windings- Integral Slot and Fractional Slot, distributed and concentrated, full pitch and short pitch windings. Pitch factor, distribution factor, winding factor and EMF equation, numerical

problems. Harmonics in generated EMF, suppression of harmonics, Armature reaction, Leakage reactance, Synchronous reactance & synchronous impedance-Experimental determination of synchronous reactance, Phasor diagram. Voltage regulation by synchronous impedance method, MMF method, ZPF method and ASA methods. Salient pole alternators- Two reaction theory, Experimental determination of X_d&X_q, Phasor diagram, regulation of salient pole alternator, numerical problems.

UNIT 4: (~10 Lecture Hours)

Parallel operation of Synchronous generators and Synchronous Motors:

Parallel operation of Synchronous generators: Synchronization methods, synchronizing power, torque, parallel operation and Load sharing. Effect of change of excitation and mechanical power input, Analysis of short circuit current waveform-determination of sub-transient, transient and steady state reactance, numerical problems.

Synchronous Motors: 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, numerical problems.

UNIT 5: (~5 Lecture Hours)

Single phase induction motors and Special motors: Constructional features, double revolving field theory, equivalent circuit-determination of parameters split phase starting methods, stepper motor, BLDC motor, Applications, numerical problems.

Text Books:

1. P. S. Bimbhra, Electrical Machinery, 7th Edition, Khanna Publishers, 2011.
2. J.B. Gupta. Theory & Performance of Electrical Machines Published by S.K. Kataria & Sons, 2015 Edition.
3. I. J. Nagrath and D. P. Kothari, Electric Machines, 5th Edition, McGraw Hill Education, 2017.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, Electric Machinery, 6th Edition, McGraw Hill Education, 2005.
2. M. G. Say, Performance and design of AC machines, CBS Publishers, 2002.
3. A. S. Langsdorf, Theory of Alternating Current Machinery, 2nd Edition, McGraw Hill Education, 1984.

Course Outcomes:

1. Analyze the construction and operating characteristics of Induction motor, synchronous machines and fractional KW machines.
2. Analyze the Induction motor and Synchronous machine performance for different loading conditions, as well operating in parallel.
3. Carry out different speed control methods and various tests to assess the performance of AC Machines.
4. Identify and design the suitable AC machine for the desired application based on their characteristics.
5. Understand Different starting methods of AC Machines.
6. Apply conceptual things to implement real time electrical problems in commercial and domestic application.

II Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC114BP	**3**	**-**	**-**	**3**

POWER SYSTEMS-I

Prerequisites: Basic Electrical Engineering, Electrical Machines-I and Circuits Theory

Objectives:

1. To understand the conventional and non-conventional power generating stations.
2. To understand economic aspects of power generation.
3. To understand mechanical design of transmission lines and underground cables.
4. To understand and calculate Transmission line parameters

UNIT 1: (~11 Lecture Hours)
Introduction to Power systems and present –Day scenario.
Thermal Power Stations: Line diagram of Thermal Power Station (TPS)– Brief description of TPS components.
Hydroelectric Power Stations: Schematic arrangement of hydro-electric power station-types; Components of Hydro- electric power station. Estimation of power developed from a given catchment area; heads and efficiencies.
Nuclear Power Stations: Functional Block diagram of nuclear Power Station (NPS). Principle of operation of nuclear reactor. Brief description of NPS components.
Gas Power Stations: Principle of Operation and Components (Block Diagram Approach Only)
Renewable Energy source: Types of sources for power generation; Concept of Solar power generation and wind power generation.

UNIT 2: (~9 Lecture Hours)
Economic Aspects of Power Generation: Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors. Power factor - disadvantages of low power factor – causes of low power factor, power factor improvement techniques – Numerical problems.

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

UNIT 3: (~9 Lecture Hours)
Overhead Line Insulators: Types of Insulators, String efficiency and Methods for improvement, Capacitance grading and Static Shielding-Numerical Problems.

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 4: (~8 Lecture Hours)

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

UNIT 5: (~8 Lecture Hours)

Transmission Line Parameters: Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase lines, concept of Geometrical Mean Radius(GMR) & Geometrical Mean Diameter(GMD), Calculation of capacitance for single phase and three phase lines, effect of ground on capacitance - Numerical Problems.

Text Books:

1. J.B. Gupta, A course in Power systems, S.K.Kataria & Sons Publishers, 2016.
2. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakraborti, A Text Book on Power System Engineering, Dhanpat Rai & Co. Pvt. Ltd., 2009.
3. C.L.Wadhwa, Electrical Power Systems, 7th Edition, New Age International (P) Ltd., 2016.

Reference Books:

1. John J.Grainer, W.D.Stevenson: Power System Analysis, 1st Edition, McGraw Hill Education, 2017.
2. S.N.Singh, Electrical Power Generation, Transmission and Distribution, 2nd Edition, PHI publications, 2008.
3. B.R.Gupta, Power System Analysis and Design, S.Chand & Co Publishers, 2005.

Course Outcomes:

The students will be able to

1. Understand the operation of conventional generating stations like Thermal, Hydro, Nuclear and renewable energy sources.
2. Understand the economic aspects and tariff methods of power.
3. Understand design of Insulators, sag and tension.
4. Understand structure of different underground cables and design.
5. Understand transmission line parameters.
6. Calculate transmission line parameters.

II Year B.Tech. EEE II-Semester **L T P C**
Course Code: PC11430 **- - 3 1.5**

ELECTRICAL MACHINES - II LAB

Prerequisites: Basic Electrical Engineering, Electrical Machines-I

Course Objectives:

1. To gain thorough knowledge about operation and the performance of AC Machines.
2. To understand Different starting methods of AC Machines.
3. To draw the performance characteristics of AC Machines for different load conditions.

PART A(compulsory)

1. OC & SC tests on a single phase transformer.
2. Brake test on a 3 phase Induction Motor.
3. No load & blocked rotor tests on a 3 phase Induction Motor.
4. Equivalent circuit of a single phase Induction Motor.
5. Sumpner's test.
6. Regulation of a three phase alternator by Synchronous Impedance & MMF methods.
7. V & inverted V curves of a three phase synchronous motor.
8. Determination of X_d & X_q of a salient pole synchronous machine.

PART B (Any two Experiments from the following list)

1. Regulation of 3 phase alternator by ZPF and ASA methods.
2. Separation of core losses of a single phase transformer.
3. Parallel operation of transformers.
4. Scott connection of Transformers.

Course outcomes:

After completion of this course student should be able to

1. Analyze the characteristics of AC machines.
2. Carry out various tests to assess the performance of AC Machines
3. Understand different starting methods of AC Machines.
4. Know conceptual things to implement in real time applications.
5. Identify and analyze the methods for determination of regulation of a synchronous generator based on the merits.
6. Draw the equivalent circuits of different AC machines by conducting suitable experiments.

II Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC11431	**-**	**-**	**3**	**1.5**

ELECTRICAL SIMULATION LAB

Prerequisites: Basic Electrical Engineering and Circuits Theory

Objectives:

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

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.
3. Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power
4. Verification of Network Theorems
   i) Superposition theorem. ii) Thevenin's theorem.
5. Verification of maximum power transfer and reciprocity theorems.
6. Simulation of AC Circuits –Nodal and mesh analysis.
7. Locating the Zeros and Poles and Plotting the Pole-Zero maps in s - plane for the given transfer function.
8. Simulation of Transient response of RL,RC and RLC Circuits.
9. Solar Pv System

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

10. Waveform Synthesis using Laplace Transform
11. Harmonic analysis of non-sinusoidal waveforms.
12. Measurement of active Power of three phase circuit for balanced and unbalanced load.
13. Simulation of single phase diode bridge rectifiers with filter for R & RL load.

Course Outcomes:

After going through this lab the student will be able to

1. Apply different signals to different systems and observe the responses.
2. Analyze networks by various techniques or theorems.
3. Synthesize a given wave form using Laplace Transform.
4. Analyze bridge rectifiers.
5. Measure three phase power in a balanced or unbalanced three phase load.
6. Construct and analyze a solar PV system.Using appropriate SIMULATION packages.

II Year B.Tech EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC11429	**-**	**-**	**3**	**1.5**

DIGITAL ELECTRONICS LAB

Prerequisites:-Nil-

Course Objectives:

1. To test and verify digital subsystems used in digital systems.
2. To design combinational logic circuits using Digital ICs.
3. To design sequential logic circuitsusing Digital ICs.
4. To Calculate and Verify resolution of ADC and DACs.

List of Experiments:

(Any 12 from given the list to be done)

1. Realize and design Logic gates using discrete components and devices. Realize and verify the functionality of the following circuits. (Experiments 2-6)
2. Logic Gates using ICs.
3. 3 to 8 Decoder using LS74138 IC.
4. 8 to 1 Multiplexer using LS74151 IC.
5. 2 to 4 De-Multiplexer using LS74155 IC.
6. 4-bit Comparator using LS7485 IC.
7. Realize and design4-bit Binary to Grey Code Converter.
8. Design a 16-bit Adder/Subtractor using 4-bit Adder/Subtractor.
9. Design a 16 to 4 Priority Encoder using two 8 to 3 Priority Encoders. Realize and verify the functionality of the following circuits. (Experiments 10-13)
10. D and JK-Flip-Flops using LS7474 and LS7476 ICs.
11. Universal Shift Register using LS74194/195 IC.
12. Up/Down Counter using LS74192/193 IC.
13. Decade Counter using LS7490 IC.
14. Realize an 8-bit Successive Approximation Analog to Digital Converter using ADC0808 and verify the resolution with theoretical value.
15. Realize an 8-bit R-2R Ladder Digital to Analog Converter using DAC0808 and verify the resolution with theoretical value.
16. Verify the Read and Write operations on a 16X4 RAM using LS74189 IC.

Online Resources:

1. https://courses.cs.washington.edu/courses/cse370/08wi/pdfs/lectures/04- Logic%20gates.pdf
1. http://www.cs.utoronto.ca/~sengels/csc258/lectures/Gates_1up.pdf
2. http://www.site.uottawa.ca/~petriu/Digital-Logic.pdf
3. https://www.slideshare.net/wewemahir/adc-dac-54832376
4. www.cse.cuhk.edu.hk/~khwong/www2/ceng4480/ceng4480_A3.pp
5. http://www.electronics-tutorial.net/digital-logic-families/
6. http://digitalbyte.weebly.com/logic-families.html
7. https://www.tutorialspoint.com/digital_circuits/digital_circuits_shift_registers.htm

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Identify Digital ICs.
2. Identify function of Digital ICs. Test and Verify the Digital ICs.
3. Design Combinational logic circuits.
4. Design Sequential logic circuits.
5. Calculate Resolution of ADCs and DACs.

II Year B.Tech.EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: MC114BE	**2**	**-**	**-**	**-**

ENVIRONMENTAL SCIENCES

(Mandatory Course)
(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites:-Nil-

Course Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations.
4. Create awareness about environmental issues & identify the sustainable solutions.
5. To sensitize the young minds to wildlife environment.
6. To develop the knowledge on various environmental components and their interrelation with each other.

UNIT 1: (~5 Lecture Hours)

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, Bio-magnification, ecosystem value, services and carrying capacity, Field visits.

UNIT 2: (~7 Lecture Hours)

Natural Resources: Introduction, 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, Energy Resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT 3: (~6 Lecture Hours)

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.

UNIT 4: (~7 Lecture Hours)

Environmental Pollution and Control Technologies: 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.

Global Environmental Problems and Global Efforts: Climate 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 5: (~6 Lecture Hours)

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.

Text Books:

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

Reference Books:

1. Richard T. Wright, Environmental Science: towards a sustainable future, PHL Learning Private Ltd. New Delhi, 2008.

2. Gilbert M. Masters and Wendell P. Ela, Environmental Engineering and science, PHI Learning Pvt. Ltd, 2008.
3. Daniel B. Botkin & Edward A. Keller, Environmental Science, Wiley INDIA Edition.
4. Anubha Kaushik, Environmental Studies, 4th Edition, New age international publishers.
5. Dr. M. Anji Reddy, Text book of Environmental Science and Technology, BS Publications, 2007.

Online Resources:

1. http://www.open.edu/openlearn/free-courses/full-catalogue
2. https://www.edx.org/course/subject/environmental-studies
3. https://www.mooc-list.com/tags/environmental-management
4. https://www.enviroblog.net

Course Outcomes:

After completion of the course, students will be able to

1. Benefited by various ecological principles and environmental regulations for sustainable development.
2. Able to identify/analyze/evaluate/demonstrate the consequences of developmental activities and mitigation measures.
3. Develop the advanced technologies in protection/conservation of resources in sustainable approach.
4. Improved in attitude & thinking of the students will be positively towards earth & environment.
5. Benefited by knowing the concepts like Green Buildings, Low Carbon Lifestyle, International conventions etc.
6. It helps the students to improve the quality of life.

III Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: HS115CH	**3**	**-**	**-**	**3**

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To provide the basic concepts of economics.
2. To interlink the concepts of economics for effective business decision making.
3. To provide fundamental knowledge of accounting, process of preparing accounting statements and interpret them thereby.

UNIT 1: (~9 Lecture Hours)

Managerial Economics and Demand Analysis:

Managerial Economics: Introduction to Economics, Definition of Managerial Economics, Nature and Scope of Managerial Economics, Multidisciplinary nature of Managerial Economics, Role of Managerial Economist.

Demand Analysis: Introduction to Demand, Determinants of demand, Law of demand and its Exceptions, Nature of demand, Movement and Shift of demand curve.

UNIT 2: (~9 Lecture Hours)

Elasticity of Demand, Demand Forecasting and Production Analysis:

Elasticity of demand: Concept of Elasticity of demand, Types of Elasticity- Price, Income, Cross and Advertising. Factors affecting and Significance of Elasticity of demand.

Demand Forecasting: Need for Demand Forecasting - Factors governing Demand Forecasting, Methods of Demand Forecasting (Survey methods and Statistical methods).

Production Analysis: Factors of Production, Production Function. Production function with one variable input, Two variable inputs using Isoquant and Isocosts. Optimal combination of Resources using Isoquants and Isocosts. Laws of returns, Economies and Diseconomies of Scale.

UNIT 3: (~10 Lecture Hours)

Cost Analysis, Market Structure and Pricing:

Cost Analysis: Cost concepts, Short run and Long run Cost analysis.

Market Structures: Classification of Markets, Features of Perfect Competition, Monopoly, Monopolistic, Oligopoly and Duopoly.

Pricing: Pricing Objectives, Methods of Pricing and Pricing Strategies.

UNIT 4: (~10 Lecture Hours)

Introduction to Financial Accounting:

Financial Accounting: Introduction to Accounting, Double Entry Book-Keeping, Accounting Principles, Accounting Terminology. Journal, Ledger, Trial Balance, Final Accounts with Adjustments (Simple Problems).

UNIT 5: (~10 Lecture Hours)

Financial Analysis and Interpretation:

Ratio Analysis: Need, importance and significance of Ratio Analysis, Liquidity Ratios, Profitability Ratios, Activity Ratios, Solvency Ratios, Interpretation of Ratios for decision making (Simple problems).

Reference Books:

1. P L Mehta, Managerial Economics, Analysis, Problems & Cases, 8th Edition, Sultan Chand & Sons, 2001.
2. S.N. Maheshwari, Suneel K Maheshwari and Sharad K. Maheshwari, Financial Accounting, 5th Edition, Vikas Publishing House Pvt. Ltd, 2015.
3. D.N.Dwivedi, Managerial Economics, 9th Edition, Vikas Publishing House Pvt. Ltd, 2016.
4. R.L.Varshney and K.L Maheshwari, Managerial Economics, 14th Edition, Sultan Chand & Sons, 2005.
5. T.S.Grewal, Double Entry Book Keeping, Sultan Chand & Sons, Reprint 2006.

Online Resources:

1. Managerial Economics http://nptel.ac.in/courses/110101005/162.
2. Financial Accounting http://nptel.ac.in/courses/110107073.

Course Outcomes:

After completion of the course, students will be able to

1. Cognize the Basic Concepts of Economics.
2. Analyze the economic concepts for using discretion in business problem solving.
3. Comprehend the concepts of Accounting for business decision making.
4. Assimilate the basic Accounting Procedure and interpret the statements.
5. Analogize the external business environment for attainment of business goals.
6. Enable forecasting and analyzing the external business environment.

III Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC115CJ	**3**	**1**	**-**	**4**

POWER SYSTEMS – II

Prerequisites: Power Systems-I, Electromagnetic fields

Course Objectives:

1. To understand performance of short, medium and long transmission lines.
2. To understand factors influencing performance of transmission lines and power transients.
3. To understand different substations and distribution system.
4. To understand voltage control and per unit representation.

UNIT 1: (~12 Lecture Hours)

Performance of Transmission lines: Classification of Transmission Lines: Performance of Short and Medium Transmission Lines: - Short, medium model representations-Nominal-T, Nominal-π, A, B, C, D Constants, regulation and efficiency for symmetrical & Asymmetrical Networks- Numerical Problems.

Performance of Long Transmission Lines: Long Transmission Line model representation- Rigorous Solution, evaluation of A,B,C,D Constants, Surge Impedance and SIL of Long Lines, Equivalent-T and Equivalent-π network models -Numerical problems.

UNIT 2: (~10 Lecture Hours)

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- Numerical problems.

Power System Transients: Types of System Transients - 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. Bewley's Lattice Diagrams -Numerical problems.

UNIT 3: (~8 Lecture Hours)

Substations: Classification of substations: Air insulated substations - Indoor & Outdoor substations: layout and equipment. Different Bus bar arrangements in the Sub-Stations with relevant diagrams.

Gas Insulated Substations (GIS) – Advantages of GIS, different types, single line diagram of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

Per Unit representation of Power System: Single line representation of Power system, impedance and reactance diagrams, Per-Unit Systems. Changing the base of per unit quantities. Advantages of p.u. systems-Numerical problems.

UNIT 4: (~10 Lecture Hours)

Voltage Control and Compensation: Introduction-Methods of voltage control, shunt and Series capacitors and inductors, tap changing transformers, Synchronous Phase modifiers. Concepts of Load Compensation-Load ability characteristics of overhead lines, uncompen-sated transmission lines-symmetrical lineradial line with asynchronous load-compensation of lines-Numerical problems.

UNIT 5: (~8 Lecture Hours)

D.C. Distribution Systems: Classification- Comparison of DC vs. AC and Under-Ground vs. Over Head Distribution Systems- Requirements and Design features of Distribution Systems-Voltage Drop Calculations-Radial D.C Distributor fed at one end and at both ends with equal and unequal Voltages - Ring Main Distributor- Numerical Problems.

A.C. Distribution Systems: Voltage Drop Calculations- power factor referred to receiving end voltage and w.r.t. load voltages- Numerical Problems.

Text Books :

1. C.L.Wadhwa, Electrical Power Systems, 7th Edition, New Age International (P) Ltd, 2016.
2. John J.Grainer & W.D. Stevenson, Power System Analysis, 1st Edition, McGraw Hill Education, 2017.
3. M. L. Soni, P. V. Gupta, U.S. Bhatnagar, A. Chakrabarti, A Text Book on Power System Engineering, Dhanpat Rai & Co Pvt. Ltd, 2013.

Reference Books:

1. J. Nagarath & D. P Kothari, Power Systems Engineering, 2nd Edition, TMH, 2010.
2. J.B. Gupta, A course in Power systems, S.K.Kataria & Sons Publishers, 2016.
3. B. R. Gupta, Power System Analysis and Design, S.Chand and Co, 2005.

Course Outcomes:

The students will be able to

1. Analyze the performance of small, medium and Long Transmission lines.
2. Understand various factors governing the performance of transmission lines and power transients.
3. Understand Air insulated and Gas Insulated Substations.
4. Understand Voltage control in power systems.
5. Understand per unit representation.
6. Analyze and Understand D.C and A.C distribution systems.

III Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC115BV	**3**	**-**	**-**	**3**

CONTROL SYSTEMS

Prerequisites: Circuits theory

Objectives:

1. To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response.
2. To assess the system performance using time domain analysis and methods for improving it.
3. To assess the system performance using frequency domain analysis and techniques for improving the performance.
4. To understand the different types compensators performance.

UNIT 1: (~9 Lecture Hours)
Introduction: Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feedback Characteristics, Effects of feedback.
Mathematical Models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems.

UNIT 2: (~9 Lecture Hours)
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 3: (~10 Lecture Hours)
Time Response Analysis & Stability 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. The concept of stability-Routh's stability criterion – qualitative stability and conditional stability-limitations of Routh's 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.

UNIT 4: (~9 Lecture Hours)
Frequency Response & Stability 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. Polar Plots, Nyquist Plots- Stability Analysis.

Compensation Techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers.

UNIT 5: (~9 Lecture Hours)

State Space Analysis of Continuous Time 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 it's Properties – Concepts of Controllability and Observability.

Text Books:

1. B. C. Kuo, Automatic Control Systems, 8th Edition, John Wiley & Son's, 2003.
2. I. J. Nagrath, M. Gopal, Control Systems Engineering, 2nd Edition, New Age International (P) Ltd., 2018.

Reference Books:

1. A. NagoorKani, Control Systems, 3rd Edition, RBA Publications, 2017.
2. Katsuhiko Ogata, Modern Control Engineering, 5th Edition, Pearson Education, 2015.
3. Norman S Nise, Control Systems Engg., 3rd Edition, Wiley India, 2018.
4. Narciso F. Macia, George J. Thaler, Modelling & Control Of Dynamic Systems, Thomson Publishers.

Course Outcomes:

After completion of this course the student is able to

1. Obtain the mathematical model of Translational and rotational mechanical systems
2. Obtain the mathematical models of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver
3. Improve the system performance by selecting a suitable controller and/ or compensator for a specific application.
4. Apply various time domain and frequency domain techniques to assess the system performance.
5. Able to design Lag, Lead and Lag-Lead compensators.
6. Test system Controllability and Observability using state space representation.

III Year B.Tech. EEE I-Semester **L T P C**
Course Code: PE115CA **03 - - 3**

ELECTRICAL MEASUREMENTS & INSTRUMENTATION

(Professional Elective-I)

Prerequisites: Basic Electrical & Electronics Engineering, Network theory, Electromagnetic fields.

Course objectives:

1. To introduce the basic principles of all measuring instruments
2. To deal with the measurement of voltage, current, Power factor, power, energy, phase and frequency.
3. To measure the resistance, inductance and capacitance by using various bridges.
4. To introduce the basic principles of Transducers used for measurement of displacement, velocity, angular velocity.

UNIT 1: (~9 Lecture Hours)

Classification – deflecting, control and damping torques –Construction and principle of operation of moving coil, moving iron and electrostatic voltmeters and ammeters– extension of ranges.

UNIT 2: (~9 Lecture Hours)

Potentiometers: DC Potentiometers - Basic Slide wire and Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications.

Instrument Transformer: CT and PT – Ratio and phase angle errors

Cathode Ray Oscilloscope: Dual trace and dual beam oscilloscope, digital oscilloscope, oscilloscope as test and measuring instrument(Elementary treatment only), measurement of phase of amplitude, phase and frequency using CRO.

UNIT 3: (~9 Lecture Hours)

Measurement of Power: 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.

Measurement of Energy: Single phase induction type energy meter-driving and braking torques-errors and compensations-testing by phantom

loading using R.S.S. meter and Three phase energy meter. Power Factor Measurement, Frequency Meter and Synchroscope.

UNIT 4: (~8 Lecture Hours)

DC Bridges: Measurement of low, medium and high resistance using Kelvin's bridge, Kelvin's double bridge, Wheatstone bridge, Carey Foster bridge, loss of charge method.

AC Bridges: Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge - Owen's bridge. Measurement of capacitance and loss angle-De-Sauty's Bridge– Schering Bridge

Measurement of frequency-Wien's bridge.

UNIT 5: (~9 Lecture Hours)

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 strain, Gauge sensitivity, Displacement, Velocity, Angular Velocity, Torque measurement by Strain Gauge only.

Text Books:

1. E.W.Golding, F.C.Widdis, Electrical Measurements and measuring Instruments, 3rd Edition, Reem Publications Pvt Ltd., 2011.
2. A. K. Sawhney, A course on Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai & Co. Publications, 2015.
3. G.K.Banerjee, Electrical and Electronic Measurements, PHI Learning Pvt. Ltd., 2014.

Reference Books:

1. R.K.Rajput, Electrical & Electronic Measurements & Instrumentation, S. Chand and Company Ltd., 2008.
2. Reissland.M.U, Electrical Measurements: Fundamentals, Concepts, Applications, 1st Edition, New Age International (P) Ltd, 2010.
3. S.C.Bhargava, Electrical Measuring Instruments and Measurements, BS Publications, 2012.

Course Outcomes:

After completion of this lab the student is able to

1. Acquire the knowledge about the measuring instruments for measurement of voltage, current, power, energy, CRO.

2. Analyze the extension of range of measuring instruments and Different types of errors and their reduction techniques, CT and PT, Potentiometers.
3. Evaluate power factor and frequency, phase sequence using power factor meter, frequency meter and synchroscope.
4. Measure the resistance, inductance and capacitance by using various bridges and phase and frequency using CRO.
5. Acquire the knowledge about Transducers and measurement of displacement ,velocity, angular velocity using strain gauge
6. Apply the conceptual thing to real world electrical and electronics problems and applications.

III Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PE115BS	**3**	**-**	**-**	**3**

COMPUTER ORGANIZATION

(Professional Elective-I)

Prerequisites:-Nil-

Course Objectives: To understand the basic structure and operation of a digital computer.

1. To realize the CPU design for a given instruction set.
2. To design functional units for floating point and fixed point operations.
3. To visualize the hierarchical memory system.
4. To understand the requirements of IO interfacing with the computer.
5. To comprehend the advantage of instruction level parallelism and pipelining for high performance Processor design.

UNIT 1: (~11 Lecture hours)

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation: Fixed Point Representation, Floating Point Representation.

Register Transfer Language and Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfer, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers, Computer Instructions – Instruction cycle, Memory – Reference Instructions, Input – Output and Interrupt.

UNIT 2: (~8 Lecture hours)

Micro Programmed Control: Control Memory, Address Sequencing, Micro Program Example, Design of Control Unit - Hard Wired Control, Micro Programmed Control.

Central Processing Unit - Stack organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

UNIT 3: (~9 Lecture hours)

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories, Performance Considerations, Virtual Memories, Secondary Storage.

UNIT 4: (~9 Lecture hours)
Input-output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP), Serial Communication.

UNIT 5: (~8 Lecture hours)
Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors.
Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor Arbitration. Interprocessor Communication and Synchronization.

Text Books:
1. M.Moris Mano, Computer System Architecture, 3rd Edition, PHI / Pearson, 2008.
2. Car Hamacher, Zvonks Vranesic, Safwat Zaky, Computer Organization, 5th Edition, McGraw Hill Education, 2011.

References:
1. William Stallings, Computer Organization and Architecture, 8th Edition, PHI/Pearson, 2006.
2. John P. Hayes, Computer Architecture and Organization, 3rd Edition, McGraw, Hill International, 2012.

Online Resources:
1. NPTEL Course on Computer Organization and Architecture by Prof. S. Raman -IITM https://www.youtube.com/watch?v=leWKvuZVUE8&list=PLQObLunIEgaQ7Drxp8yCmsJqidgSsTqlw
2. Web Course for NPTEL on Computer Organization and Architecture -https://nptel.ac.in/courses/106103068/pdf/coa.pdf

Course Outcomes:
At the end of the course the student should be able to
1. Recognize the basic building blocks and functional details of a CPU.
2. Discuss the features of a general purpose computer.
3. Demonstrate the construction and operation of individual building blocks of a CPU
4. Illustrate the generation of control and timing signals for the CPU design.
5. Employ advanced architectural features for performance improvement of the CPU
6. Understand the parallelism both in terms of single and multiple processors.

III Year B.Tech. EEE I-Semester **L T P C**
Course Code: PE115CL **3 - - 3**

SPECIAL MACHINES
(Professional Elective-I)

Prerequisites: Electrical Machines –I, Electrical Machines –II

Course Objectives:
1. To impart knowledge on Construction, principle of operation and performance of Synchronous Reluctance Motors.
2. To Emphasis on the Construction, principle of operation, control and performance of Stepper Motors.
3. Understand the Construction, principle of operation, control and performance of Switched Reluctance Motors.
4. Analyze the Construction, principle of operation, control and performance of Permanent magnet brushless D.C. motors.
5. To get acquainted with the principle of operation and performance of Permanent Magnet Synchronous Motors

UNIT 1: (~9 Lecture Hours)
Synchronous Reluctance motors: Constructional features – Types – Axial and Radial flux motors – Operating principles– Variable Reluctance Motors – Voltage and Torque Equations – Phasor diagram – Performance characteristics – Applications.

UNIT 2: (~9 Lecture Hours)
Stepper Motors: Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi-stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle– Applications.

UNIT 3: (~9 Lecture Hours)
Switched Reluctance Motors: Constructional features – Rotary and Linear SRM – Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control –Applications.

UNIT 4: (~9 Lecture Hours)
Permanent Magnet Brushless DC Motors: Permanent Magnet materials – Minor hysteresis loop and recoil line- Magnetic characteristics- Permeance coefficient - Principle of operation – Types – Magnetic circuit

analysis-EMF and torque equations-Commutation-Power Converter Circuits and their controllers-Motor characteristics and control– Applications.

UNIT 5: (~9 Lecture Hours)

Permanent Magnet Synchronous Motors (PMSM): Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings – Phasor diagram– Torque/speed characteristics – Power controllers – Converter Volt-ampere requirements– Applications.

Text Books:

1. K.Venkataratnam, Special Electrical Machines, Universities Press (India) Private Limited, 2008
2. T.J.E. Miller, Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, Oxford, 1989.
3. T. Kenjo, Stepping Motors and Their Microprocessor Controls, Clarendon Press London, 1984.

Reference Books:

1. R.Krishnan, Switched Reluctance Motor Drives-Modeling, Simulation, Analysis, Design and Application, CRC Press, New York, 2001.
2. P.P. Aearnley, Stepping Motors – A Guide to Motor Theory and Pr, Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, Permanent Magnet and Brushless DC Motors, Clarendon Press, London, 1988.
4. E.G. Janardanan, Special Electrical Machines, PHI learning Private Limited, Delhi, 2014.

Course Outcomes:

After completion of this course, the student

1. Able to compute inductance and capacitance for different configurations of transmission lines.
2. Able to analyze the performance of transmission lines
3. Can understand various factors governing the performance of transmission lines
4. Can understand transient's phenomenon of transmission lines.
5. Able to calculate sag and tension calculations.
6. Able to understand overhead line insulators and underground cables.

III Year B.Tech. EEE I-Semester **L T P C**
Course Code: PC11540 **- - 3 1.5**

ELECTRICAL MEASUREMENTS & INSTRUMENTATION LAB

Course Objectives:

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

The following experiments are compulsory experiments:

1. Crompton D.C.Potentiometer–Calibration of PMMC ammeter and PMMC voltmeter.
2. Calibration of dynamometer power factor meter.
3. Calibration LPF wattmeter – by Phantom testing.
4. Measurement of 3-Phase reactive power with single-phase wattmeter.
5. Calibration and Testing of single phase energy Meter.
6. Kelvin's double Bridge – Measurement of resistance.
7. Schering Bridge & Anderson Bridge.
8. Measurement of displacement with the help of LVDT.

In addition **any TWO** of the following are to be conducted:

9. Measurement of 3-phase power with single watt meter and two CTs.
10. Dielectric oil testing using H.T. testing Kit.
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 Silsbee's method.

Course Outcomes:

After completion of this lab the student is able to

1. Calibrate the PMMC type Voltmeters, Ammeters, LPF wattmeter, energy meter and dynamometer type power factor meter

2. Determine the Low Resistance, Inductance, Capacitance
3. Test the Instrument transformers and methods of indicating dielectric strength and turns ratio of a transformer.
4. Measure the three phase active and reactive power using watt meters.
5. Identifying the use of transducers and measurement of Non-Electrical Quantities.
6. Apply the conceptual thing to real world electrical and electronics problems and applications

III Year B.Tech. EEE I-Semester **L T P C**
Course Code: PC11535 **- - 3 1.5**

CONTROL SYSTEMS LAB

Prerequisites: Basic Electrical Engineering, Circuits Theory

Course Objectives:

1. To understand the different ways of system representations such as Transfer function representation and state space representations
2. To assess the system performance using time domain analysis and methods for improving it
3. To assess the system performance using frequency domain analysis and techniques for improving the performance
4. To get the performance of various devices (Servo motors etc.)
5. To design various controllers and compensators to improve system performance

The following are **compulsory** experiments:

Part – A

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. (a) Effect of feedback on DC servo motor (b) Characteristics of AC servo motor
5. Transfer function of DC motor & DC generator
6. Temperature controller using PID
7. Effect of P, PD, PI, PID Controller on a second order systems
8. Lag and lead compensation – Magnitude and phase plot

In addition **any TWO** of the following are to be conducted:

Part – B

1. a) Simulation of P, PI, PID Controller b) Linear system analysis (Time domain analysis, Error analysis) using MATLAB
2. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB.
3. State space model for classical transfer function using MATLAB.
4. Design of Lead-Lag compensator for the given system and with specification using MATLAB.
5. Magnetic amplifier- series and parallel connections.

Course Outcomes:

After completion of this course the student is able to

1. Obtain the transfer function of DC Motor and DC Generators
2. Develop the logic to realize the Boolean expressions and able to control the speed and directions of stepper motor by Programmable logic controller.
3. Analyze the time response of second order RLC system.
4. Analyze the P PI and PID controllers on the second order systems.
5. Design Lag, Lead and Lag- Lead compensators.
6. Analyze by simulation State space models, stability by root locus and bode plots for classical transfer function using MATLAB software.

III Year B.Tech. EEE I-Semester **L T P C**
Course Code: HS11542 **- - 2 1**

EMPLOYABILITY AND SOFT SKILLS LAB

(Common to CSE, ECE, EEE, ETE & IT)

Course Objectives:

1. To address various challenges of communication as well as behavioural traits faced by individuals at workplace and organizations through case studies and interactions.
2. To help the students engage with other members confidently through various discussions and presentations.
3. To help the students write business documents and generate content effectively.
4. To enhance soft skills among the students and to enable them to understand its impact on employability.
5. To equip the students with career planning and employability.

UNIT 1: (~2 lecture hours and 4 practical sessions)

Interpersonal and Intrapersonal Communication Skills

1. Factors impacting Communication Skills: Self awareness-Self analysis -Self appraisal-Self esteem.
2. Barriers and Factors impacting Interpersonal and Intrapersonal communication, both verbal and non-verbal communication.
3. Student presentations through **SWOT** Analysis.

UNIT 2: (~2 lecture hours and 6 practical sessions)

Team Building and Group Dynamics

1. Factors influencing group behavior-Process of group development: Forming, Storming, Norming, Performing, Adjourning-Group Members individual roles and responsibilities.
2. Critical thinking and logical reasoning through SPELT Analysis-Six Thinking Hats and Mind Maps.
3. Student presentations and performance through group activities.

UNIT 3: (~2 lecture hours and 4 practical sessions)

Written Communication Skills

1. Processes in writing: Brainstorming-Drafting-Revising-Editing - Proof Reading-Final draft.
2. Prerequisites for Effective Writing: Lexical Resource: Vocabulary in context-Grammatical function in use: Syntax and accuracy-Researching-Note-making-Support visuals-Procedures and processes - Structuring and Formatting-IT skills.

3. Writing tasks assigned in the written format of E-mail correspondence – Covering letter and Resume building – Technical Report Writing – Developing a Portfolio.

UNIT 4: (~2 lecture hours and 4 practical sessions**)**

Presentation Skills

1. Processes in presentation: Analysing the audience - Selecting a topic - Defining the objective - Preparing the structure - Practicing and Delivering.
2. Prerequisites for Effective Presentation: Content development-Researching-Note-taking-Drafting-Organizing-Formatting-Structuring-Visual support-IT Skills
3. Presentations are done through Image description – Poster Presentation-Pecha kucha.

UNIT 5: (~2 lecture hours and 4 practical sessions**)**

Group Discussions and Interview Skills

1. Prerequisites for Group Discussion – Definition, Rules, Types – Topical issues, Case studies, Abstract topics – Evaluation criteria – Content, Analytical and Reasoning skills, Creativity, Organisation skills, Communication skills, Listening skills, Leadership skills, Body language, Group behavior.
2. Prerequisites for Interview Skills-Researching companies, Reading job descriptions, Using appropriate language, Using **STAR** method to answer interview questions-**S-**Situation, background setting and context **T**- Task or Target, specifics of what's required, when, where, who **A**-Action, what you did, skills used, behaviours, characteristics **R**- Result – outcome, what happened? How valuable the learning was?
3. Student presentations and performance through Group Discussions and Mock Interviews.

Reference Books:

1. T.M.Farhathullah, Communication Skills for Technical Students, Orient BlackSwan Pvt. Ltd., 2002.
2. Sangeetha Sharma, Binod Mishra, Communication Skills for Engineers and Scientists, PH1 Learning Pvt.Ltd., 2011.
3. Sanjay Kumar and Pushp Lata, Communication Skills, 2nd Education, Oxford Higher Education, 2015.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_hs22/preview
2. https://onlinecourses.nptel.ac.in/noc19_hs04/preview

Course Outcomes:

After the completion of the course, the students will be able to

1. Apply basic communication skills (LSRW) in work-related situations.
2. Acquire, organize, interpret and evaluate information for effective communications within a group.
3. Demonstrate the ability to combine ideas or information in new ways and present information on guided and structured format.
4. Make decisions and solve problems by specifying goals, identifying resources and constraints and evaluating results.
5. Display personal qualities such as responsibility, self-management, self-confidence, ethical behaviour and respect for self and others.
6. Learn to work cooperatively with people of diverse backgrounds and abilities, identify group's goals and values and contribute to a group process with ideas, suggestions and efforts.

III Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: HS116CY	**3**	**-**	**-**	**3**

FUNDAMENTALS OF MANAGEMENT

(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites: Managerial Economics and Financial Analysis

Course Objectives:

1. To educate the importance of Management in Business Decision Making.
2. To implant the conceptual aspects required for Managerial Decision Making.
3. To elicit the practical application of Management in Engineering Decision Making.

UNIT 1: (~10 lectures)

Introduction to Management:

Management: Definition - Nature and Scope – Functions - Managerial Roles - Levels of Management - Managerial Skills - Challenges of Management - Evolution of Management - Classical Approach- Scientific Management and Administrative Theory - The Behavioural approach - The Quantitative approach - The Systems Approach - Contingency Approach – Corporate Social Responsibility for Businesses.

UNIT 2: (~7 lectures)

Planning and Decision Making

Planning: General Framework for Planning - Planning Process - Types of Plans and Types of Planning - Management by Objectives - Development of Business Strategy - Strategic Planning Process – Environmental Scanning.

Decision Making - Characteristics of Decision Making - Types of Decisions - Steps in Decision Making - Approaches to Decision Making - Individual Decision Making and Group Decision Making.

UNIT 3: (~10 lectures)

Organization and HRM

Organization: Principles of Organization - Organizational Design - Departmentation-Delegation-Empowerment-Centralization - Decentralization - Recentralization-Organizational Structures-Organizational Culture-Organizational Climate and Organizational Change.

Human Resource Management: Talent Management – Importance - Human Resource Planning - Recruitment and Selection - Training and Development - Performance Appraisal - Transitioning.

UNIT 4: (~10 lectures)

Leading and Motivation

Leading: Leadership - Characteristics of a Leader - Power and Authority - Leadership Styles - Leadership Theories – Traditional Leadership Theories - Behavioral Leadership Theories - Situational Leadership Theories - Leader as Mentor and Coach – Team Leadership.

Motivation - Types of Motivation - Relationship between Motivation and Performance - Content Motivational Theories – Abraham Maslow's Need Hierarchy Theory - Fredrick Herzberg's Two Factor Theory – Mc. Gregor Theory -X and Y.

UNIT 5: (~10 lectures)

Controlling

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

Text Books:

1. Stephen P. Robbins, Fundamentals of Management, Pearson Education, 2009.
2. Dr. M. Sakthivel Murugan, Management Principles and Practices, 1st Edition, New Age International (P) Ltd., 2010.
3. Y. K Bhushan, Fundamentals of Business organization and Management, 16th Edition, Sultan Chand and Sons, 2004.

Reference Books:

1. Andrew Du Brin, Management Essentials, 9th Edition, Cengage Learning, 2012.
2. VSP Rao, Management (Text & cases), 2nd Edition, Excel Books, 2012.
3. James A.F. Stoner, R.Edward Freeman and Danial R. Gilbert, Management, 6th Edition, Prentice-Hall of India Pvt. Ltd.,
4. NVS Raju, Industrial Engineering & Management, Cengage Learning, 2013.

Online Resources:

Concept of Management and Evolution of Management Thought http://nptel.ac.in/courses/122108038/9

Course Outcomes:

After learning the contents of this course, the student must be able to

1. Associate the concept of Management in practical scenario for effective decision making.

2. Synthesize the preparation of effective plans in strategizing the decision making process.
3. Circumscribe the authority responsibility conduct in an organization.
4. Intuit the human resource management in an organization towards achievement of effectiveness.
5. Cognize the role of leader and motivation in the attainment of objectives of an organization.
6. Understand articulating techniques of controlling in the process of an organization.

III Year B.Tech. EEE II-Semester **L T P C**
Course Code: PC116DF **3 - - 3**

MICROPROCESSORS AND MICROCONTROLLERS

Prerequisite: Digital System Design

Course Objectives:

1. Describe the architecture of Microprocessor and Microcontrollers.
2. Solve problems by acquiring knowledge of machine language programming.
3. Experimenting with various I/O interfacing with Microcontroller.
4. Classify various Microcontrollers.

UNIT 1: (~10 Lecture Hours)
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.

UNIT 2: (~8 Lecture Hours)
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 3: (~10 Lecture Hours)
Introduction to Microcontrollers: Overview of8051 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 4: (~8 Lecture Hours)
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 5: (~8 Lecture Hours)
I/O and Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Text Books:

1. A. K. Ray and K.M. Bhurchandani, Advanced Microprocessors and Peripherals, 2nd Edition, TMH, 2006.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, The 8051 Microcontroller ad Embedded. Systems. Using Assembly and C. 2nd Edition, Pearson, 2008.

Reference Books:

1. D. V. Hall, Microprocessors and Interfacing, 2nd Edition, TMGH, 2006.
2. K.Uma Rao, Andhe Pallavi The 8051 Microcontrollers, Architecture and Programming and Applications, Pearson, 2009.
3. Kenneth. J.Ayala, 3rd Edition, The 8051 Microcontroller, Cengage Learning, 2006.

Online Resources:

1. https://lecturenotes.in/subject/22/microprocessor-and-microcontroller-mpmc
2. https://onlinecourses.nptel.ac.in/noc18_ec03/preview
3. http://nptel.ac.in/courses/108107029/

Course Outcomes:

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

1. Familiarize with the internal architecture and organization of 8086 and 8051.
2. Write assembly language programs using 8086 and 8051.
3. Design and develop micro controller based systems using 8051 interfacing.
4. Apply the knowledge of 8051 micro controller in real time applications.
5. Relate the memory organization and memory interface to 8086/8051.
6. Discuss various serial communication interface standards.

III Year B.Tech. EEE II-Semester **L T P C**
Course Code: PC116DH **3 - - 3**

POWER ELECTRONICS

Prerequisites: Circuits theory, Analog Electronics.

Course Objectives:

1. To compare characteristics of switching devices.
2. To evaluate the performance of rectifiers.
3. To Design DC-DC converter with given characteristics
4. To Analyze and evaluate the operation of Inverters and Cyclo converter

UNIT 1: (~10 Lecture Hours)
Power semiconductor devices: Concept of power electronics, scope and applications, types of power converters, power semiconductor switches and their V-I characteristics-diodes, SCR, TRIAC, power BJT, Power MOSFET and IGBT, Thyristor ratings and protection, Methods of SCR commutation, Triggering circuits for SCR.

UNIT 2: (~10 Lecture Hours)
Phase Controlled Rectifiers: Principles of single-phase fully-controlled converter with R, RL&RLE loads, Principles of single-phase half-controlled converter with RL&RLE loads, Principles of three-phase fully controlled converter operation with highly inductive load, Effect of source inductance, Single phase and Three phase dual converters(Basic operation),numerical problems.

UNIT 3: (~8 Lecture Hours)
DC-DC Converters: Basic principles of step-down and step-up converters with R&RL loads , maximum and minimum currents, ripple current, converters classification, Switching mode regulators, Buck, Boost and Buck-Boost regulators, Isolated DC-DC converters, Flyback and forward converters, numerical problems

UNIT 4: (~8 Lecture Hours)
INVERTERS Introduction, principle of operation, performance parameters, single phase bridge inverters with R&RL loads, 3-phase bridge inverters - 120 and 180 degrees mode of operation, Voltage control of single phase inverters –single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

UNIT 5: (~9 Lecture Hours)
A.C. VOLTAGE CONTROLLERS Introduction, principle of operation of single phase voltage controllers for R& R-L loads using TRIAC and SCR

and its applications-Three phase AC voltage controllers –Basic principle of operation of Cyclo converters with R&RL Loads, numerical problems.

Text Books:

1. M.H.Rashid, Power Electronics - Circuits, Devices and Applications, PHI, 2018.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, New Delhi, 2018.

Reference Books:

1. Mohan Undeland Robin, Power Electronics - Converters, Applications and Design, 3rd Edition, John Wiley & Sons, 2007.
2. P.C .Sen, Power Electronics, McGraw Hill, 2015.
3. L.Umanand, Power Electronics: Essentials and Applications, Wiley India, 2009.

Course Outcomes:

After completion of this course, the students will be able to

1. Understand the concepts of power semiconductor devices.
2. Analyze the performance single & three phase converters.
3. Design DC-DC converters
4. Understand the operation of Inverters.
5. Analyze single phase AC voltage & dual converters.
6. Design the commutation circuits and triggering circuits

III Year B.Tech. EEE II-Semester **L T P C**
Course Code: PE116CU **3 - - 3**

DIGITAL CONTROL SYSTEMS

(Professional Elective-II)

Prerequisites: Control systems

Course Objectives:

1. To understand the concepts of Discrete Data System in comparison with continuous Data system.
2. To introduce the mathematical tool –z transform for solving linear difference equation.
3. To understand the extent concepts of state space representation to discrete time system
4. To become familiar with the design concepts of discrete time system.

UNIT 1: (~10 Lecture Hours)

Introduction: Introduction, Examples of Digital control systems- Digital to analog conversion and Analog to Digital conversion, Sample and Hold Devices, Mathematical Modeling of the Sampling process, Sampling theorem, Data reconstruction, Zero order Hold, First order hold, Polygonal and Slewer Hold.

z-Transform: Introduction, z-Transforms, Properties, Theorems and Limitations of z-Transform, Inverse z-Transform, Modified z-Transform, z-Transform method for solving difference equations.

UNIT 2: (~8 Lecture Hours)

Pulse Transfer Function: Pulse Transfer function for closed loop system, mapping between s-plane and z-plane – primary strip and complementary strip, constant Frequency Loci, constant damping ratio loci.

State Space Analysis: State Space representation of discrete time systems, Pulse Transfer Matrix, solving discrete time state space equations, State transition matrix and its properties, Methods of computing the State Transition Matrix, Discretization of continuous time state space equations.

UNIT 3: (~12 Lecture Hours)

Controllability and Observability: Definition and Theorems of controllability and Observability, Tests of controllability and Observability, duality between controllability and Observability, Relationship between controllability, Observability and transfer function, Effect of pole zero cancellation on controllability and Observability.

Stability Analysis: Stability analysis of closed loop systems in the Z-plane, transient and steady state response analysis, Jury Stability Test-

Stability Analysis using Bilinear Transformation and Routh- Hurwitz Criterion, Design of digital control system with dead beat response.

UNIT 4: (~6 Lecture Hours)
Design of Discrete Time Control System: Design based on frequency response method- Bilinear Transformation, Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and Digital PID controllers.

UNIT 5: (~8 Lecture Hours)
State Feedback Controllers & Observers: Design of State feedback controller through pole placement –Necessary and sufficient conditions, Ackerman's formula.
State Observers-Full order and Reduced order Observers

Text Books:
1. B.C Kuo, Digital Control Systems, 2nd Edition, Oxford University Press, 2012.
2. K. Ogata, Discrete Time control systems, Pearson Education, 2nd Edition, PHI, 2015.
3. M.Gopal, Digital Control Engineering, 2nd Edition, New Age International, 2014.

Reference Books:
1. C. P Kurian, V. I. George, Digital Control System, Cengage Learning India, 2012
2. M. Sami Fadali, Antonio Visioli, Digital Control Engineering Analysis and Design, 2nd Edition, Academic Press, 2012.
3. M. Gopal, Digital Control & State Variable Methods, 4th Edition, Tata McGraw Hill, 2012.

Course Outcomes:
Subsequent to completion of the course, the students will be able to
1. Distinguish between analog control systems and digital control systems by acquiring the knowledge on z-transforms and sampling for basic analysis of digital control system.
2. Develop and analyze pulse transfer function for discrete time system.
3. Analyze the performance of digital control systems using state space representation.
4. Analyze the performance and Stability of digital control systems through various classical and other methods.
5. Design Discrete-time control systems based on frequency response method i.e. lag, lead and lag-lead compensators etc.
6. Design State feedback controllers and observers using various techniques

III Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE116CZ	**3**	**-**	**-**	**3**

HIGH VOLTAGE ENGINEERING

(Professional Elective-II)

Prerequisites: Power Systems-II

Course Objectives:

This course deals with

1. The breakdown phenomenon in gaseous, liquids and solids dielectrics
2. Generation and measurements of High voltages and currents
3. Over voltages Phenomenon and Protection against over voltages
4. Testing of electrical apparatus and layout of HV laboratories

Unit 1: (~14 Lecture Hours)

Breakdown in Gases, liquid and solid Insulating materials: Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge. Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, applications of insulating materials.

Unit 2: (~7 Lecture Hours)

Generation of High Voltages: Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

Unit 3: (~7 Lecture Hours)

Measurements of High Voltages and Currents: Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

Unit 4: (~8 Lecture Hours)

Lightning and Switching Over-voltages: Charge formation in the clouds- Rate of charging of Thunder clouds, Stepped leader, Dart leader, Mechanism of Lightning Surges.Origin of Switching Surges, Characteristics of Switching Surges, Switching over-voltages in EHV and UHV Systems. Protection against over-voltages-Surge diverters For EHV systems, Protection of lines with surge diverters.

Unit 5: (~9 Lecture Hours)

High Voltage Testing of Electrical Apparatus and High Voltage Laboratories: Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and Surge arresters, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

Text Books:

1. M.S.Naidu, V. Kamaraju, High Voltage Engineering, McGraw Hill Education, 2013.
2. C. L. Wadhwa, High Voltage Engineering, 3rd Edition, New Age Science; 2010.
3. Subir Ray, 2nd Edition, An Introduction to High Voltage Engineering, 2013

Reference Books:

1. E.Kuffel, W.S.Zaengl, J.Kuffel, High Voltage Engineering Fundamentals, Newnes Publication, 2000.
2. R. Arora and W. Mosch High Voltage and Electrical Insulation Engineering, John Wiley & Sons, 2011.
3. IS standard booklets for HV Laboratory Techniques and Testing.

Note: Visit to HV Laboratories is Preferable

Course outcomes:

At the end of the course, the student will be able to

1. Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
2. Acquire Knowledge of generation and measurement of different types of high voltages and currents.
3. Analyze the phenomenon of over voltages in a power system
4. Analyze the methods of protection against over-voltages in a power system.
5. Acquire Knowledge of tests on H. V equipment as per the standards.
6. Acquire Knowledge on layout of HV laboratories.

III Year B.Tech. EEE II-Semester **L T P C**
Course Code: PE116CW **3 - - 3**

ELECTRIC & HYBRID VEHICLES

(Professional Elective-II)

Prerequisites: Electrical Machines, Power Electronics, Control Systems.

Course Objectives:

1. To understand the fundamental concepts, principles of Hybrid and Electric Vehicles.
2. To Analyze and design the hybrid and electric vehicles.
3. To know the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used energy storage devices, etc.

UNIT 1: (~10 Lecture Hours)

Introduction: Introduction to Hybrid electric vehicles: History of hybrid and electric vehicles. Social and environmental importance of hybrid and electric vehicles.

Vehicle fundamentals: Vehicle resistance, Dynamic equation, Tire-Ground Adhesion and Maximum Tractive effort, Power train tractive effort and vehicle speed. Vehicle power plant and transmission characteristics, Vehicle performance. Operating fuel economy braking performance.

UNIT 2: (~8 Lecture Hours)

Energy storage: Introduction to energy storage requirements in hybrid and electric vehicles. Electro chemical batteries and it's analysis, Ultra capacitors and it's analysis, Ultra high speed flywheels and it's analysis, Hybridization of Energy storages.

UNIT 3: (~8 Lecture Hours)

Electric Vehicles: Configurations of Electric vehicles, Performance of Electric vehicles: Traction motor characteristics, Tractive effort and transmission requirement: Gears, Clutch, Brakes, Ideal gearbox, EV motor sizing, Tractive effort in normal driving, Energy consumption.

UNIT 4: (~8 Lecture Hours)

Hybrid Electric Vehicles: Internal combustion Engines, Concept of hybrid electric drive trains, Architectures of hybrid electric drive trains, Series Hybrid electric drive trains, Parallel Hybrid electric drive trains, Series parallel Hybrid electric drive trains and complex electric drive train.

UNIT 5: (~10 Lecture Hours)

Electric Propulsion Systems: Introduction to electric components used in hybrid and electric vehicles, configuration and control of DC motor drives, configuration and control of Induction motor drives, configuration and control of Permanent magnet Motor drives, configuration and control of Switch reluctance motor drives, Drive system efficiency.

Introduction to energy management strategies: Regenerative braking.

Text books:

1. Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi Modern Electric, Hybrid Electric and Fuel Cell Vehicles-Fundamentals, Theory and Design, CRC Press, 2005.
2. Iqbal Husain, Electric and Hybrid Vehicles Design Fundamentals, CRC Press, 2003
3. James Larminie, John Lowry Electric Vehicle Technology John Wiley & Sons Ltd., 2003

Reference Books:

1. C. Mi, M. A. Masrur, D. W. Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons, 2011.
2. S. Onori, L. Serrao, G. Rizzoni, Hybrid Electric Vehicles: Energy Management Strategies, Springer, 2015.
3. T. Denton, Electric and Hybrid Vehicles, Routledge, 2016.

Course Outcomes:

At the end of this course, the students will be able to

1. Identify the difference between conventional vehicles and Electric Vehicles.
2. Understand the models to describe hybrid vehicles and their performance, various battery sources and energy storage systems.
3. Apply the concepts of electrical machines, Power Electronics for the design of Electrical Vehicles.
4. Analyze the various vehicle technologies, Drive trains, Energy storage devices and energy management strategies.
5. Evaluate the suitable combination of electric motors, power electronic converters, and battery. Evaluate energy management strategies.
6. Develop the efficient and effective Hybrid Electric Vehicles.

III Year B.Tech. EEE II-Semester **L T P C**
Course Code: PC11649 **- - 3 1.5**

MICROPROCESSORS AND MICROCONTROLLERS LAB

Course Objectives:

1. To infer the basics of the microprocessor and its assembly language.
2. To extend the basics of assembly language to the microcontroller.
3. To provide foundation on interfacing the external devices to the micro controller.
4. To develop solutions for the real time applications.

List of Experiments:

Implement the following experiments using TASM/MASM assembler for 8086 and KeilìVision IDE for 8051.

1. Write a program for 16 bit arithmetic operations for 8086 (using Various Addressing Modes).
2. Write a program for sorting an array for 8086.
3. Write a program for searching for a number or character in a string for 8086.
4. Write a program for string manipulations using string instruction of 8086.
5. Write a program using arithmetic, logical and bit manipulation instructions of 8051.
6. Write a program to verify Timer/Counter operation in 8051.
7. Write a program to verify Interrupt handling in 8051.
8. Write a program on UART Operation in 8051.
9. Write a program to interface stepper/DC motor with 8051.
10. Write a program to interface Matrix/Keyboard to 8051.
11. Write a program to interface Seven Segment Display to 8051.
12. Write a program to interface LEDs to 8051.
13. Write a program to interface LCD to 8051
14. Write a program for sequence generator using Serial Interface in 8051.
15. Write a program to interface 8bit ADC to 8051.
16. Write a program to interface DAC with 8051 to generate a analog signal.

Note: Minimum of 12 experiments to be conducted.

Online Resources:

1. https://lecturenotes.in/subject/22/microprocessor-and-microcontroller-mpmc

2. https://onlinecourses.nptel.ac.in/noc18_ec03/preview
3. http://nptel.ac.in/courses/108107029/

Course Outcomes:

At the end of this course, students will be able to

1. Illustrate the assembly language programming.
2. Design circuits for various applications using microcontroller.
3. Apply the concepts of microcontroller on real- time applications.
4. Evaluate the results of 8086 and 8051 programs.
5. Use standard test and measurement equipment to evaluate analog/digital interfaces.
6. Analyze abstract problems and apply a combination of hardware and software to address the problem.

III Year B.Tech. EEE II-Semester **L T P C**
Course Code: PC11651 **- - 3 1.5**

POWER ELECTRONICS LAB

Course Objectives:

1. To make the students to design triggering circuits & commutation circuits of SCR.
2. To introduce power electronics components from which the characteristics of SCR, IGBT and MOSFET are obtained.
3. To perform the experiments on various converters.

Part-A (All Experiments are compulsory**)**

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Study of Driver circuit of SCR and pulse transformer
3. AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. Four quadrant chopper with R and RL Loads
7. Single Phase Bridge inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads

Part-B (Any two of the following experiments)

1. Single-phase full converter using R and RL loads and single-phase AC voltage controller using R&RL loads using MATLAB.
2. Four quadrant chopper with R&RL loads circuit using MATLAB.
3. Single phase Inverter with PWM control using MATLAB
4. Three Phase half controlled bridge converter with R-load
5. Three phase inverter in 120^0 & 180^0 mode of operation.
6. Single Phase dual converter with R&RL load

Course Outcomes:

After completion of this course the students will be able to

1. Correlate theoretical and practical analysis of AC-AC, DC-AC converters
2. Analyze AC to DC converters.
3. Analyze the characteristics of SCR, MOSFET and IGBT.
4. Analyze driving circuit of SCR and commutation circuits.
5. Analyze DC-DC converters.
6. Analyze cyclo and dual converters

IVYear B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC117EM	**3**	**-**	**-**	**3**

POWER SYSTEM PROTECTION

Prerequisites: Power Systems, Microprocessors

Course Objectives:

1. To introduce all kinds of circuit breakers and relays
2. Protection of Generators, Transformers and feeder bus bars from Over voltages and other hazards.
3. To understand microprocessor based protective relays.
4. To understand system protection schemes.

UNIT 1: (~9 Lecture hours)

Circuit Breakers: Types of fuses, fuse characteristics, 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. Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum, and SF6 circuit breakers.

UNIT 2: Relays: (~9 Lecture hours)

Induction type relays. Types of Over Current Relays: Instantaneous, DMT and IDMT types. Application of relays: Over current/ under voltage relays, Directional relays. Universal torque equation, Distance relays: Impedance, Reactance, and Mho and Off-Set Mho relays, Characteristics of Distance Relays. Static Relays verses Electromagnetic Relays-comparison.

UNIT 3: (~10 Lecture hours)

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 4: (~10 Lecture hours)

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.

Microprocessor Based Protective Relays: Over Current Relay, Impedance Relay, Reactance Relay, Mho Relay, Offset Mho Relay and Directional Relay.

UNIT 5: (~7 Lecture hours)

System Protection: Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Text Books:

1. BadriRam, D.N. Viswakarma, Power System Protection and Switchgear, 2nd Edition, TMH Publications, 2018.
2. Sunil S Rao, Switchgear and Protection, 10th Edition, Khanna Publishers, 2018.
3. J.B. Gupta, Switchgear and Protection, 3rd Edition, S.K. Kataria & Sons, 2019.

Reference Books:

1. J. L.Blackburn, Protective Relaying: Principles and Applications, Marcel Dekker, 3rd Edition, New York, 2007.
2. A.G. Phadke, J. S. Thorp, Synchronized Phasor Measurements and their Applications, Springer science & Business Media, LLC, 2008.
3. D. Reimert, Protective Relaying for Power Generation Systems, Taylor and Francis, CRC Press, 2006.

Course Outcomes:

After Completion of this course students will be able to

1. Understand the types of fuses and Circuit breakers
2. Understand choice of Relays for appropriate protection of power system equipment.
3. Understand various types of Protective devices in Electrical Power Systems.
4. Interpret the existing transmission voltage levels and various means to protect the system against over voltages.
5. Understand various digital protection relays.
6. Analyze various system protection schemes.

IV Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC117EL	**3**	**-**	**-**	**3**

POWER SYSTEM ANALYSIS

Prerequisite: Power Systems-I, Power systems -II.

Course Objectives:

1. To understand and develop Y bus and Z bus matrices.
2. To know the importance of load flow studies and its importance.
3. To analyze various types of faults occur in power system.
4. To know Steady State and Transient stability of power system.
5. To understand the economic operation of the Thermal power plants.
6. To know the importance of Load frequency control.

UNIT 1: (~9 Lecture Hours)

Power Flow Studies: Network Matrices. Transmission Network Representations: Bus Admittance frame and Bus Impedance frame. **Formation of Y_{BUS}:** Direct Method only, Formation of Z_{BUS} from Y_{BU}, Numerical Problems. Necessity of Power Flow Studies, Bus classification and Notations, Convergence & Bus mismatch criteria.

Load Flow Methods: Gauss-Seidal method, Newton Raphson method in Polar and Rectangular form, Numerical Problems for one or two iterations.

UNIT 2: (~9 Lecture Hours)

Short Circuit Analysis: 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 3: (~9 Lecture Hours)

Power System Stability Analysis: Introduction to Power System Stability issues. Rotor dynamics & Swing equation, Power angle equation, 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.

UNIT 4: (~8 Lecture Hours)

Economic Operation of Power Systems: Optimal operation of Generators in Thermal Power Stations,-heat rate Curve-Cost Curve-Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses- Loss Coefficients, General transmission line loss formula.

UNIT 5: (~10 Lecture Hours)

Modeling of Governor, Turbine, Generator and Load: Mathematical Modeling of Speed Governing System-Derivation of small signal transfer function. First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models. **Generator and Load Model.**

Single Area & Two Area Load Frequency Control: Necessity of keeping frequency constant, Definitions of Control area Single area control-Block diagram representation of an isolated power system - Steady state analysis, Dynamic response - Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation, steady state response. State variable model.

Load frequency control of two area system: Tie line Model, Block diagram representation of two area power system. Uncontrolled case-Steady state analysis only.

Text Books:

1. I. J. Nagrath & D. P. Kothari Modern Power System Analysis, 4th Edition, Tata McGraw-Hill Publishing Company, 2011.
2. Dr. K.Uma Rao, Computer Techniques and Models in Power Systems, 2nd Revised Edition, I.K.International, 2014.
3. Dr. K.Uma Rao, Power System - Operation and Control, Wiley India Pvt. Ltd., 2012.

Reference Books:

1. Glenn W.Stagg, Ahmed H. El-Abiad, Computer Methods in Power System Analysis, McGraw-Hill Publishing Company
2. Olle. I. Elgerd, Electric Energy Systems Theory – An Introduction, 30th Reprint, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2007.
3. C.L.Wadhwa, Electrical Power Systems,7th Edition, New Age International (P) Limited Publishers, 2016.

4. John J.Grainer & W.D.Stevenson Power System Analysis, 1st Edition, McGraw Hill Education; July 2017.
5. Hadi Saadat, Power System Analysis, 3rd Edition TMH, 2011.

Course Outcomes:

After this course, the student will be able to

1. Develop Y_{bus} , Z_{bus} matrices for the power system networks
2. Perform the load flow analysis of power system networks using Gauss-Seidel, Newton-Raphson methods.
3. Analyze symmetrical and unsymmetrical faults in power system networks.
4. Estimate the Transient and steady state Stability for single machine infinite system.
5. Apply mathematical techniques/methods to solve economic load dispatch problems.
6. Model and analyze the single and two area Load frequency control systems for the control of frequency.

IV Year B.Tech. EEE I-Semester	L	T	P	C
Course Code: PE117DV	3	-	-	3

ELECTRIC DRIVES

(Professional Elective-III)

Prerequisite: Electrical Machines, Control Systems, Power Electronics.

Course Objectives:

1. To introduce the drive system and operating modes of drive and its characteristics.
2. To understand Speed-Torque characteristics of different motor drives by various power converter.
3. To analyse the machine behavior during motoring and braking operations.
4. To identify proper control techniques as per the load requirement.
5. To differentiate DC and AC drives suitable for an application.

UNIT 1: (~ 10 Lecture Hours)

Introduction: Electrical drives - Advantages - Parts of electrical drives - Choice of drive - Status of DC and AC drives.

Dynamics of Electrical drives: Fundamental torque equations - Speed torque conventions and Multi-quadrant operation- Equivalent Values of drive parameters-Components of load torque- Nature and classification of load torques-Time and energy loss during transient period - steady state stability and load equalisation

Control of drives: Modes of operation-Speed control and drive classification-Closed loop control of drives.

Selection of motor power rating: Thermal model of motor for heating and cooling- classes of motor duty - Determination of motor rating.

UNIT 2: (~12 Lecture Hours)

Control of DC motors by Single phase Semi and fully controlled converters: Single phase semi and fully controlled converter fed DC separately excited and series motors- Continuous current operation- Speed and torque expressions and characteristics- Related problems.

Control of DC motors by Three phase Semi and fully controlled converters: Three phase semi and fully controlled converter fed DC separately excited and series motors- Continuous current operation - Speed and torque expressions and characteristics- Related problems.

Four Quadrant operation of DC drives: Motoring operation, Electric Braking- Plugging, Dynamic, regenerative braking operation, Four quadrant

operation of DC motors by dual converters - Closed loop operation of DC motor(Block diagram only).

Control of DC motors By Choppers: Single, double and four quadrant Chopper fed DC Separately excited and series motors- Problems.

UNIT 3: (~10 Lecture Hours)

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-Closed loop operation. (Block Diagram Only)

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, Numerical problems.

UNIT 4: (~8 Lecture Hours)

Control of Synchronous Motors: Separate control and self-control of synchronous motors-operation of self-controlled synchronous motors by VSI and CSI. Load commutated CSI fed Synchronous motor- Operation - Waveforms-speed torque characteristic - Applications - Advantages - Closed loop control operation of synchronous motor drives (Block diagram only) - Variable frequency control - Cyclo converter, PWM based VSI and CSI control.

UNIT 5: (~6 Lecture Hours)

Stepper motor and Switched reluctance motor (SRM) drives: Variable reluctance-Permanent magnet-Features of stepper motor- Torque vs stepping rate characteristics-Drive circuits for stepper motors. SRM operation and control-Converter circuits-Modes of operation.

Text Books:

1. Gopal K Dubey, Fundamentals of Electric Drives, Narosa Publications, 2019.
2. Vedam Subramanyam, Electric Drives, Concepts and Applications, McGraw Hill Publications, 2011.
3. S.K. Pillai, Basics of Electric Drives, 4th Edition, New Academic Science, 2014.

Reference Books:

1. S K Pillai, Analysis of Thyristor Power-conditioned motors, University Press, 2005.
2. B. K. Bose, Modern Power Electronics, and AC Drives, Pearson 2015.
3. R. Krishnan, Electric motor drives-modeling, Analysis and control, Pearson, 2015.
4. P.V.Rao, Power Semiconductor Drives, B.S.Publications, 2008.

Course Outcomes:

After the completion of the course, the students will be able to

1. Identify the advantages of drive control over conventional control techniques.
2. Interpret the basic drive system and its performance.
3. Classify the drives for different types of loads.
4. Distinguish the motor behavior during motoring and braking modes.
5. Compare the speed control of Induction Motor from stator side and rotor side and identify their merits and de-merits.
6. Explain the performance of the drive during closed loop operation.

IV Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: PE117EN	**3**	**-**	**-**	**3**

PROGRAMMABLE LOGIC CONTROLLERS & THEIR APPLICATIONS

(Professional Elective-III)

Prerequisites: Microprocessors and Microcontrollers, Control systems.

Course Objectives:

1. To understand the generic architecture and constituent components of a Programmable Logic Controller.
2. To develop a software program using modern engineering tools and technique for PLC.
3. To apply knowledge gained about PLCs to identify few real life industrial applications.

UNIT 1: (~8 Lecture Hours)

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 2: (~10 Lecture Hours)

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 3: (~10 Lecture Hours)

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 4: (~8 Lecture Hours)

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 5: (~8 Lecture Hours)

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, Ronald A Reiss, Programmable Logic Controllers-Principle and Applications, 5th Edition, PHI, 2003.
2. JR Hackworth, F.D Hackworth, Programmable Logic Controllers-Programming Methods and Applications,1st Edition, Pearson, 2006.

References:

1. L.A. Bryan and E.A. Bryan, Programmable Controllers-Theory and applications, 2nd Edition, An Industrial Text Company Publication.
2. Dag H. Hanssen, Programmable Logic Controllers: A Practical Approach to IEC 61131 3 using CODESYS, 1st Edition, John Wiley & Sons, Ltd, 2015.

Online resources:

1. https://nptel.ac.in/courses/108105063/pdf/L 19(SM)%20(IA&C)%20(EE)NPTEL).pdf
2. https://nptel.ac.in/courses/112102011/downloads/faq%20of%20module%204.pdf
3. http://ee.sharif.edu/~industrialcontrol/LADDER_LOGIC_Tutorial.pdf
4. http://jjackson.eng.ua.edu/courses/ece485/lectures/

Course Outcomes:

Upon the completion of the course the student will be able to

1. Develop and explain the working of PLC with the help of a block diagram.
2. Execute, debug and test the programs developed for digital and analog operations.
3. Apply the knowledge of timer/counters with PLCs
4. Reproduce block diagram representation on industrial applications using PLC.
5. Understanding to interface various devices to PLCs
6. Acquire the knowledge of analog devices and their interfacing with PLCs

IV Year B.Tech. EEE I-Semester **L T P C**
Course Code: PE117DW **3 - - 3**

ELECTRICAL DISTRIBUTION SYSTEMS

(Professional Elective-III)

Prerequisites: Power Systems-I, Power Systems-II, Power System Protection

Course Objectives:

To distinguish between transmission and distribution systems

1. To understand design considerations of feeders
2. To compute voltage drop and power loss in feeders
3. To understand protection of distribution systems
4. To examine the power factor improvement and voltage control
5. To study the impacts of distributed generation on distribution systems

UNIT 1: (~5 Lecture Hours)

Load Modeling and characteristics: Introduction to distribution system, Load modeling and characteristics. Coincidence factor - contribution factor - Loss factor - Relationship between the load factor and loss factor, Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

UNIT 2: (~12 Lecture Hours)

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.

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).

UNIT 3: (~10 Lecture Hours)

Distributed Generation and System Analysis: Introduction of distributed generation sources like Solar PV, small wind & Hydro ,Bio-mass/Bio-Diesel generators into distribution systems, Their basic models

and interfacing arrangements with low and medium voltage grids, Voltage drop and power loss calculations on distribution systems with and without distributed generators.

UNIT 4: (~9 Lecture Hours)

Co-ordination of Protective Devices: Objectives of distribution system protection, types of common faults and procedure for fault calculations, Principle of operation of Auto-line Sectionalizes.

Objectives of protection coordination, general coordination procedure, Types of protection coordination: Fuse to Fuse, Auto-Recloser to Fuse, Circuit breaker to Fuse, Circuit breaker to Auto-Recloser. Co-ordination procedure of protective devices with distributed generators.

UNIT 5: (~9 Lecture Hours)

Compensation For Power Factor Improvement: - Types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), effect of series capacitors, Calculation of Power factor correction, capacitor allocation - Economic justification of capacitors - best capacitor location.

Voltage Control: Importance of voltage control, methods of voltage control, Equipment for voltage control, effect of Automatic Voltage Booster and Automatic Voltage Regulator, line drop compensation, voltage fluctuations.

Text books:

1. Turan Gonen, Electric Power Distribution system Engineering, 3rd Edition, CRC Press, 2014.
2. V. Kamaraju, Electrical Power Distribution Systems, 2nd Edition, Tata McGraw Hill Publishing Company, 2010.
3. M. K. Khedkar, G. M. Dhole, Electric Power Distribution Automation, University Science Press, 2010.

Reference Books:

1. G. Ram Murthy, Electrical Power Distribution hand book, 2nd Edition, University press, 2004.
2. A.S. Pabla, Electric Power Distribution, 6th Edition, Tata McGraw Hill Publishing Company, 2011.
3. J B Gupta, A Course in Power Systems, 11th Edition, S K KATARIA & Sons, 2013.

Course Outcomes:

After completion of this course, the student able to

1. Acquire the knowledge on Coincidence factor, contribution factor, Loss factor and characteristics of load.
2. Design and analyze the substations based on the load, geographical data, ratings of the equipment, number of incoming and outgoing feeders and determine the optimal location of substation.
3. Design the basic models of distributed generators and their interfacing arrangements with grid for different sources like solar PV, wind , small hydro and biomass power.
4. Acquire the knowledge on over current protective devices like Fuse, Circuit breaker, Auto-Re-closer and Line sectionalize.
5. Apply the co-ordination procedure on over current protective devices with and without distributed generators included in the distribution system.
6. Apply reactive power compensation techniques in various scenario of the distribution system to limit the voltage drops at the remote ends to the suitable levels.

IV Year B. Tech EEE I-Semester	L	T	P	C
Course Code: PE117ES	3	-	-	3

UTILIZATION OF ELECTRICAL ENERGY

(Professional Elective-IV)

Pre Requisite: Electrical Machines-I, Electrical Machines-II

Course Objectives:

1. To understand applications of Electrical energy for Heating and Welding..
2. To study various types of Electric drives and their characteristics.
3. To understand fundamentals of Illumination.
4. To understand various Traction systems and different services.

UNIT 1: (~10 Lecture Hours)

Electric Heating & Welding:

Electric Heating: Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating.

Electric Welding: Resistance and arc welding, electric welding equipment, comparison between A.C and D.C welding.

UNIT 2: (~10 Lecture Hours)

Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. 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 3: (~10 Lecture Hours)

Electric Traction-I: System of electric traction and track electrification, Review of existing electric traction system in India. Special features of traction motor, methods of electric braking-plugging rheostatic braking and regenerative braking. Mechanics of train movement, Speed-time curves for different services- trapezoidal and quadrilateral speed time curves.

UNIT 4: (~7 Lecture Hours)

Electric Traction-II: Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

UNIT 5: (~8 Lecture Hours)

Train Lighting: Systems of train lighting, Special requirements of train lighting, Single Battery system, Double Battery parallel block systems, Modified Train Lighting System, Silicon Blocker Rectifier, End on generation.

Text Books :

1. H. Partab, Art & science of Utilization of Electrical Energy, Dhanpat Rai & Sons-2017
2. H. Partab, Modern Electric Traction, Dhanpat Rai and Sons, 2018.
3. G. C. Garg, Utilization of Electric power and Electric Traction, 3rd Edition, Khanna Publishers, 2004.

Reference Books:

1. R. K. Rajput, Utilization of Electrical Power, 2nd Edition, Laxmi Publications, 2014.
2. C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, 3rd Edition, New Age International (P) Limited, 2010.
3. N.V. Suryanarayana, Utilization of electrical Power including Electric drives and Electric traction, 2nd Edition, New Age International (P) Ltd, 2014.

Course Outcomes:

Subsequent to completion of the course, the student should be able to

1. Acquire knowledge about characteristics of various Electric Drives.
2. Categorize and analyze different aspects & methods of Utilization of electrical energy from both and industrial point of view.
3. Identify the type of device/scheme Utilization of Electrical energy for any given application.
4. Design some of the electrical energy Utilization systems namely Heating equipment, Lighting schemes etc.
5. Apply the concepts of Utilization of Electrical energy to determining the ratings, specifications for different types of services namely traction, heating, illumination etc. through appropriate calculations.
6. Choose a suitable method for Heating, Welding, Traction and Illumination.

IV Year B.Tech. EEE I Semester	L	T	P	C
Course Code: PE117EG	3	-	-	3

LINE COMMUTATED & ACTIVE RECTIFIERS

(Professional Elective-IV)

Prerequisites: Power Electronics

Course Objectives:

1. To analyze diode and SCR rectifiers.
2. To design of three phase rectifiers.
3. To analyze of multi-level converters.
4. To analyze of flyback converters

UNIT 1: (~8 Lecture Hours)

Diode Rectifiers with passive filtering Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current waveshape, effect of source inductance; commutation overlap.

UNIT 2: (~10 Lecture Hours)

Thyristor Rectifiers with passive filtering Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current waveshape.

UNIT 3: (~10 Lecture Hours)

Multi-Pulse converter - Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6- pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation-Single-phase ac-dc single-switch boost converter (6 Hours) Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed-loop control structure.

UNIT 4: (~8 Lecture Hours)

AC-DC Bidirectional boost converter - Review of 1-Phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and Regenerating Modes. Phasor Diagrams, Closed-Loop Control structure.

UNIT 5: (~8 Lecture Hours)

Isolated Single-Phase AC-DC Flyback Converter - DC-DC Flyback Converter, Output Voltage as a Function of Duty Ratio and Transformer Turns Ratio. Power Circuit of AC-DC Flyback Converter, Steady State Analysis, Unity Power Factor Operation, Closed Loop Control Structure.

Text Books:

1. G. De, Principles of Thyristorised Converters, Oxford & IBH Publishing Co, 1988.
2. J.G. Kassakian, M. F. Schlecht, G. C. Verghese, Principles of Power Electronics, Addison Wesley, 1991.

References Books:

1. L. Umanand, Power Electronics: Essentials and Applications, Wiley India, Reprint 2010.
2. N. Mohan, Robbins, T. M. Undeland, Power Electronics: Converters, Applications and Design, John Wiley & Sons, 2014.
3. R. W. Erickson, D. Maksimovic, Fundamentals of Power Electronics, Springer Science & Business Media, 2001.

Course Outcomes:

After completion of this course, the students will be able to

1. Analyze controlled rectifier circuits.
2. Understand the operation of line-commutated rectifiers-6 pulse and multi-pulse configurations.
3. Understand the operation of PWM rectifiers-operation in rectification and regeneration modes and lagging, leading and unity power factor mode.
4. Analyze of DC-DC converters.
5. Analyze flyback converters.
6. Design of multi-pulse converters.

IV Year B. Tech. EEE I-Semester	L	T	P	C
Course Code: PE117EP	3	-	-	3

SMART ELECTRIC GRID

(Professional Elective IV)

Prerequisites: Power Systems-II, Electrical Distribution Systems.

Course Objectives:

1. To group various aspects of the smart grid
2. To defend smart grid design to meet the needs of a utility
3. To select issues and challenges that remain to be solved
4. 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.

UNIT 1: (~8 Lecture Hours)

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 2: (~8 Lecture Hours)

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 3: (~10 Lecture Hours)

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 4: (~8 Lecture Hours)

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 5: (~10 Lecture Hours)

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.

Course Outcomes:

Upon the completion of the course, the students will be able to

1. Recite the structure of an electricity market in either regulated or deregulated market conditions.
2. Understand the advantages of DC distribution and developing technologies in distribution.
3. 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.
4. Analyze the development of smart and intelligent domestic systems.
5. Implement the market by framing the factors to influence the customer acceptance and response.
6. Identify the efficient electric end use alternative technologies.

IV Year B.Tech. EEE I-Semester **L T P C**
Course Code: PC11760 **- - 2 1**

POWER SYSTEMS LAB

Prerequisite: Power Systems & Electrical Machines

Course Objectives:

1. To understand the performance characteristics of various relays like IDMT Over current relay, over voltage/ under voltage relays and differential relays.
2. To find sequence impedances of 3-ϕ synchronous machine and Transformer and fault analysis of generator.
3. To simulate the formation of Y and Z bus using MATLAB simulation.
4. To perform Load flow analysis using GS and FD methods

Part-A (Compulsory)

1. Testing of CT, PT and Insulator string.
2. ABCD constants, Regulation and Efficiency of a 3-ϕ transmission line model
3. Characteristics of IDMT over current relay.
4. Sequence impedances of 3-ϕ synchronous machine.
5. Characteristics of over voltage and under voltage relay.
6. Differential protection of 1-ϕ transformer.
7. Sequence impedances of 3-ϕ transformer.
8. LG, LL, LLG and 3-φ fault analysis of 3-ϕ synchronous machine.

Part – B (Any TWO from the following list)

9. Formation of y_{bus} and z_{bus} .
10. Load flow analysis using Gauss Seidal (GS) method.
11. Load flow analysis using Fast Decoupled (FD) method.
12. Transient stability analysis for single machine connected to infinite bus by point by point method.

Course Outcomes:

After completion of this lab, the students should be able to

1. Understand operation of CT, PT and Insulator string.
2. Understand Different protection relays.
3. Understand the process of finding sequence impedance of generator and transformer.
4. Understand different fault analysis on generator**.**
5. Understand the formation of y_{bus} and z_{bus} with MATLAB simulation.
6. Understand the load flow analysis using GS method and FD method.

IV Year B.Tech. EEE II Semester	**L**	**T**	**P**	**C**
Course Code: HS118FK	**3**	**-**	**-**	**3**

ENTREPRENEURSHIP AND PROJECT MANAGEMENT

(Common to EEE, ECE, CSE, IT & ETE)

Prerequisites: Managerial Economics and Financial Analysis (MEFA), Fundamentals of Management (FM)

Course Objectives:

1. To inculcate the entrepreneurial knowledge required to start and/or to run a business.
2. To hone the entrepreneurial skills and creating sensibility in entrepreneurial establishment.
3. To develop strategic skills in the project planning and implementation.

UNIT 1: (~7 Lecture Hours)

Introduction to Entrepreneurship

Entrepreneurship: Introduction to Entrepreneurship and Entrepreneur - Characteristic and skills of an Entrepreneur - Factors affecting Entrepreneurship development - Types of Entrepreneurs - Entrepreneur Vs Intrapreneur, Entrepreneur Vs Entrepreneurship - Women Entrepreneurs - Growth and Problems - Incubation Centers.

UNIT 2: (~10 Lecture Hours)

Entrepreneurial business selection and Entrepreneurial Finance

Entrepreneurial business selection: Criteria for selection of Business Structure-Types of Business Structures - Sole Proprietorship-Partnership - Limited Liability Partnership - One-person company - Joint stock company – Features - Merits & Demerits.

Entrepreneurial Finance: Factors affecting Fixed Capital and Working Capital requirements - Sources of raising Finance - Financial Institutions in India.

UNIT 3: (~10 Lecture Hours)

Profit Planning Techniques

Capital Budgeting: Introduction-Need and Importance of Capital Budgeting -Traditional methods - Payback Period Method - ARR Method. Discounted Cash Flow Method-NPV-PI and IRR (simple problems).

Break-Even Analysis: Need, Scope and Significance - Assumptions - Advantages and Limitations - Practical Applications (with simple problems)

UNIT 4: (~10 Lecture Hours)
Project Management

Network Analysis: Introduction to Network analysis – PERT & CPM Analysis. Identification of Critical Path - Probability of Completing the Project within a given time - Calculation of Float/Slack - Importance of PERT & CPM in Decision Making.

UNIT 5: (~8 Lecture Hours)
Entrepreneurial Marketing

Marketing: Need for a New Product development process - Essentials of Marketing Management - Key success factors in Marketing - Marketing mix - Market Segmentation and Marketing Strategies based on PLC.

Text Books:

1. Dr. S. S.Khanka, Entrepreneurial Development, 1st Edition, S. Chand & Company, 2018.
2. L.S.Srinath, PERT & CPM-Principles & Applications, 3rd Edition, EWP, 2012.
3. Khan and Jain, Financial Management, 6th Edition, TMH, 2012.

Reference Books:

1. Philip Kotler, Marketing Management, 14th Edition, Pearson, 2013.
2. Robert. D. Hisirch, Mathew. J. Manimal, Michael. P. Peter, Dean A. Shepherd, Entrepreneurship, 9th Edition, McGraw Hill, 2017.
3. S. D. Sharma, Operations Research, 1st Edition, Macmillan, 2007.
4. Tulsian, Business organization & Management, 1st Edition, Pearson, 2008.

Online Resources:

Management Science II: http://nptel.ac.in/courses/122106032/

Course Outcomes:

After completion of the course, student will be able to

1. Possess sensibleness and skills required for establishment of business.
2. Construe the entrepreneurial ingenuity required for business functioning.
3. Give perception on the probable business structures for entrepreneurial decisions
4. Scrutinize the probable financial propositions in investment process.
5. Evaluate the entrepreneurial project feasibility of implementation and its profitability.
6. Delve the market for the product developed through entrepreneurial establishment.

IV Year B.Tech EEE II- Semester	**L**	**T**	**P**	**C**
Course Code: P118FN	**3**	**-**	**-**	**3**

GRID INTEGRATION OF RENEWABLE ENERGY SYSTEMS

(Professional Elective-V)

Prerequisites: Power Systems-I, Power Systems-II, Power Electronics

Course Objectives:

1. To describe the concepts of different renewable energy sources.
2. To explain the concepts of solar, wind energy, biomass, ocean energy, geothermal and hydro power generation system.
3. To describe the utilization of different storage technologies.
4. To analyze the issues involved in the integration of renewable energy sources to the grid.

UNIT 1: (~7 Lecture hours)

Introduction: Renewable Sources of Energy-Grid-Supplied Electricity-Distributed Generation Renewable Energy Economics-Calculation of Electricity Generation Costs-Demand side Management Options –Supply side Management Options-Modern Electronic Controls of Power Systems.

UNIT 2: (~9 Lecture hours)

Solar and Wind energy Systems: Solar thermal power generation. Solar Photovoltaics- energy conversion principle-classifications-equivalent circuit-characteristics-Cell efficiency- Limitations-PV modules-MPPT algorithms. Power and energy from wind - types of electric generators for wind power generation, Singly fed and doubly fed Induction generator, PMSM generator, Dynamics matching- performance of wind generators - economic considerations

UNIT 3: (~9 Lecture hours)

Other renewable energy sources: Bioenergy, Bio-fuels - classification - biomass conversion technologies-applications; OTEC Systems, tidal energy-wave energy-Geothermal energy-mini, micro and pico-hydro power generation

UNIT 4: (~9 Lecture hours)

Storage Devices: Super capacitor-SMES- Battery storage-flywheel storage-compressed air storage- Fuel cells–types and applications; MHD generators-backup -System design-industrial and domestic applications of storage devices.

UNIT 5: (~9 Lecture hours)

Integration of Alternative Sources of Energy with the grid: Principles of Power Injection-Instantaneous Active and Reactive Power Control Approach Integration of Multiple Renewable Energy Sources-Islanding and Interconnection Control-DG Control and Power Injection. Interconnection Technologies -Standards and Codes for Interconnection-Interconnection Considerations -Interconnection Examples for Alternative Energy Sources.

Text Books:

1. Felix A. Farret, M. Godoy Simoes, Integration of Alternative Sources of Energy, John Wiley & Sons, INC, 2006.
2. D.Mukherjee, S.Chakrabarti: Fundamentals of Renewable Energy Systems, New Age International publishers, 2011.
3. Gilbert M. Masters: Renewable and Efficient Electric Power Systems, John Wiley & Sons, INC, 2004.

Reference Books:

1. Rai G D, Solar Energy Utilization, 5th Edition, Khanna Publishers, 2004.
2. B H Khan, Non-Conventional Energy Resources, 2nd Edition, Tata McGraw-Hill, 2009.
3. Remus Teodorescu, Marco Liserre, Pedro Rodríguez: Grid Converters for Photovoltaic and Wind Power Systems, John Wiley & Sons, 2011.

Course Outcomes:

At the end of this course, the students will be able to

1. Describe the concepts of different renewable energy sources
2. Explain the concepts of solar energy conversion systems
3. Explain the concepts of wind energy based electricity generation systems
4. Describe the utilization of different storage technologies
5. Describe the concepts of renewable energy sources like biomass, ocean energy and hydro power generation system
6. Analyze the issues involved in the integration of renewable energy sources with the grid.

IV Year B. Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE118FA	**3**	**-**	**-**	**3**

ADVANCED POWER ELECTRONICS

(Professional Elective-V)

Prerequisites: Power Electronics, Electrical Circuits.

Course Objectives:

1. To understand the operation of advanced power electronic topologies.
2. To understand various configurations of converters.
3. To analyze various power converters and identify their applications.
4. To understand operation of Switched mode power supplies.

UNIT 1: (~8 Lecture Hours)

Advanced Power Semiconductor Devices: Basic structure and operation of : MOS Turn Off Thyristor (MTO) – Emitter Turn Off Thyristor (ETO) – Integrated Gate Commutated Thyristor (IGCT) – MOS Controlled Thyristor (MCT)-Gate turn Off Thyristor (GTO)-Comparison of devices.

UNIT 2: (~10 Lecture Hours)

Switch mode power supplies:

DC Power supplies- Fly back Converter-Forward converter- Push-Pull converter- Half bridge converter-Full Bridge Converter-Resonant DC power supplies-Bidirectional power supplies-Applications.

AC power supplies- Resonant AC power supplies-bidirectional AC power supplies-UPS

UNIT 3: (~9 Lecture Hours)

Resonant Inverters : Series resonant inverters with unidirectional and bidirectional switches-Analysis of resonant inverter with bidirectional switches-half bridge and full bridge topology - Frequency response of series resonant inverters- for series loaded, parallel loaded and series-parallel loaded - Parallel resonant inverters- Numerical problems.

UNIT 4: (~8 Lecture Hours)

Resonant Converters: Zero Current Switching (ZCS) resonant converters- L type and M type ZCS resonant converter - Zero Voltage Switching (ZVS) resonant converters - Comparison between ZCS and ZVS resonant converters- Two quadrant ZVS resonant converters- Resonant dc link inverters-Evaluation of L and C for ZCS inverter- Numerical Problems.

Unit 5: (~10 Lecture Hours)

Multi-level Inverters (MLI): Multi level concept, Classification of Multi Level Inverters. Principle of operation and main features of Diode clamped Multi Level Inverters, Cascaded Multi Level Inverters and Flying Capacitor Multi Level Inverters (limited to three level inverters only), Comparison of MLIs.

Pulse Width Modulation (PWM) Techniques: Sinusoidal PWM (SPWM), Harmonic Injection PWM, Space Vector Pulse Width Modulation (SVPWM), Hysteresis controller.

Text Books :

1. Muhammad H. Rashid, Power Electronics: Devices, circuits and Applications, 4th Edition, Pearson Education, 2017.
2. Ned Mohan, Tore M. Undeland, Willilam P. Robbins, Power Electronics, 3rd Edition, John Wiley and sons, 2002.
3. P.S. Bimbra, Power Electronics, 4th Edition, Khanna Publishers, 2018.

Reference Books:

1. M.D. Singh, K.B. Khanchandani, Power Electronics, 2nd Edition, McGraw Hill, 2008.
2. G.K.Dubey, S.R. Doradla, A. Joshi, R.M.K. Sinha, Thyristorised Power Controllers, 1st Edition, New Age International Publishers, 2005.

Online resources:

NPTEL Video Courses - https://onlinecourses.nptel.ac.in/noc19_ee15, http://www.nptelvideos.in/2012/11/power-electronics.html.

Course Outcomes:

Subsequent to completion of the course, the students will be able to

1. Acquire knowledge about analysis and design of various converter topologies Viz. DC- DC converters, Resonant Inverters and Resonant converters.
2. Analyze various Multi Level Inverter topologies.
3. Analyze various Switch Mode Power Supplies.
4. Choose an appropriate converter topology for a particular application.
5. Choose a suitable control technique for a given application.
6. Apply knowledge acquired to increase the level of inverters.

IV Year B.Tech. EEE II Semester	**L**	**T**	**P**	**C**
Course Code: PE118FD	**3**	**-**	**-**	**3**

AI TECHNIQUES IN ELECTRICAL ENGINEERING

(Professional Elective-V)

Prerequisites: Electrical Machines, Power Systems Analysis.

Course Objectives:

1. To understand soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms.
2. To understand the concepts of feed forward neural networks and about feedback neural networks.
3. To practice the concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy controller
4. To analyze genetic algorithm, genetic operations and genetic mutations.

UNIT 1: (~10 Lecture Hours)

Artificial Neural Networks: Introduction, Artificial Intelligence and Neural networks, Models of Neuron Network-Architectures-McCulloch-Pitts Model-Knowledge representation,–Learning process-Error correction learning, Hebbian learning-Competitive learning-Boltzman learning, supervised learning-Unsupervised learning–Reinforcement learning.

UNIT 2: (~9 Lecture Hours)

Ann Paradigms: Perceptron,Multi-layer perceptron - Back propagation Algorithm (BPA), Self-Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT 3: (~10 Lecture Hours)

Fuzzy Logic: Introduction-Fuzzy versus crisp, Fuzzy sets-Membership function-Basic Fuzzy set operations, Properties of Fuzzy sets-Fuzzy Cartesian Product, Operations on Fuzzy relations-Fuzzy logic–Fuzzy Quantifiers, Fuzzy Inference-Fuzzy Rule based system, Defuzzification methods.

UNIT 4: (~9 Lecture Hours)

Genetic Algorithms: Introduction-Encoding-Fitness Function-Reproduction operators, Genetic Modeling-Genetic operators-Cross over-Single site cross over, Two point cross over –Multi point cross over Uniform cross over, Matrix cross over-Cross over Rate-Inversion & Deletion, Mutation operator –Mutation –Mutation Rate-Bit-wise operators, Generational cycle-convergence of Genetic Algorithm.

UNIT 5: (~8 Lecture Hours)

Applications of AI Techniques: Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, Speed control of DC and AC Motors.

Text Books:

1. S.Rajasekaran, G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, 2003.
2. S.Rajasekaran, G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Systems & Evolutionary Algorithms, 2nd Edition, PHI, 2017.
3. Rober J.Schalkoff, Artificial Neural Networks, Tata McGraw Hill Edition, 2011.

Reference Books:

1. Philip.D.Wasserman, Neural Computing - Theory & Practice, Van Nostrand Reinhold Co., New York, 1989.
2. Bart Kosko, Neural Network & Fuzzy System, Prentice Hall,1992
3. D.E.Goldberg, Genetic Algorithms, Addison-Wesley 1999.
4. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rd Edition, John Wiley & sons, 2011.

Course Outcomes:

After this course, the students will be able to

1. Understand soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms.
2. Develop feed forward neural networks, feedback neural networks and learning techniques.
3. Apply fuzzy logic principles in various systems and fuzzy set theory.
4. Analyze genetic algorithm, genetic operations and genetic mutations.
5. Apply fuzzy logic control in electrical engineering
6. Apply genetic algorithms in electrical engineering.

IV Year B. Tech. EEE II-Semester **L T P C**
Course Code: PE118FJ **3 - - 3**

ELECTRICAL MACHINE MODELING & ANALYSIS

(Professional Elective –VI)

Prerequisites: Electrical Machines-I, Electrical Machines-II

Course Objectives:

1. To acquire the knowledge of generalized theory of electrical machines.
2. To represent the DC and AC machines as Basic Two Pole machine.
3. To model the electrical machines with voltage, current, torque and speed equations.
4. To investigate the steady state behavior of the electrical machines.

UNIT 1: (~9 Lecture Hours)
Basic concepts of Modeling : Basic Two-pole Machine representation of DC machines, 3-phase synchronous machine and 3-phase induction machine, Kron's Primitive 2- axis Machine -voltage, current and Torque equations.

UNIT 2: (~9 Lecture Hours)
DC Machine Modeling: Mathematical model of separately excited D.C motor , D.C Series motor, D.C Shunt motor and D.C. Compound motor in state variable form, Transfer function of the motor - Numerical problems.

UNIT 3: (~9 Lecture Hours)
Linear transformation: Phase transformation (a, b, c to α, β) – Active transformation (α, β, to d, q), Circuit model of a 3 phase Induction motor – Linear transformation - Phase Transformation –Transformation to a Reference frame – Two axis models for induction motor.

UNIT 4: (~9 Lecture Hours)
Modeling of three phase Induction Machine: Voltage and current Equations in stator reference frame – equation in Rotor reference frame – Equations in state – space form, Torque equation.

UNIT 5: (~9 Lecture Hours)
Modeling of Synchronous Machine: Two axis representation of Synchronous Motor, Synchronous machine inductances –voltage equations in the rotor reference frame – Torque equation.

Text Books:

1. P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff, Analysis of Electrical Machinery and Drive systems, 3rd Edition, IEEE Press, 2013.

2. P.S.Bhimbra, Generalised theory of Electrical Machines, 6th Edition, Khanna Publishers, 1981.
3. Chee Mun Ong, Dynamic simulation of Electric machinery using Matlab /Simulink, Prentice Hall, 1998.

Reference Books:

1. R.Krishnan, Electric Motor Drives - Modeling, Analysis & control, 1st Edition, Pearson Publications, 2015.
2. Vedam Subramanyam, Thyristor control of Electric Drives, Tata McGraw Hill Education, 2011.

Course Outcomes:

After completion of this course the students will be able to

1. Apply knowledge of behavior of DC motors to model and analyze for different applications.
2. Analyze the characteristics of different types of DC motors to design suitable controllers.
3. Acquire knowledge of reference frame theory for AC machines.
4. Evaluate the steady state and transient behavior of induction and synchronous machines to propose the suitability of drives for different industrial applications.
5. Analyze the 2-Phase induction machines using voltage and current equations to differentiate the behavior and to propose their applications in real world.
6. Apply knowledge of 2- axis concept to obtain torque equation of Induction and synchronous motors.

IV Year B. Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE118FH	**3**	**-**	**-**	**3**

EHV AC TRANSMISSION
(Professional Elective-VI)

Prerequisites: Power Systems-II, Electromagnetic Fields

Course Objectives:
1. To understand in-depth inter related concepts of Extra High Voltage AC transmission.
2. To gain understanding of Lightning, Switching and Dynamic Overvoltage Studies.
3. To introduce the concept of Insulation Coordination in EHV Systems.

UNIT 1: (~8 Lecture Hours)
Introduction to EHVAC: Necessity of EHV AC transmission - advantages and numericals. Power handling capacity and line losses- Mechanical considerations - Resistance of Conductors - Bundled conductors- Bundle Spacing and Bundle Radius-Examples.
Review of Line Inductance and Capacitance Calculations - Sequence Inductances and Capacitances. Modes of propagation – Inclusion of Ground Return and Frequency Dependence in Line Parameters Calculations – Examples.

UNIT 2: (~8 Lecture Hours)
Voltage Gradients of Conductors: Electrostatics - Field of sphere gap - Field of line charges and properties - Charge - Potential relations for Multi-Conductors -Surface voltage gradient on conductors - Distribution of Voltage Gradient on Sub-conductors of a Bundle-Examples.
Corona Effects: 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.

UNIT 3: (~8 Lecture Hours)
Radio Interference: Corona pulses generation, properties, limits - frequency spectrum - modes of propagation - Excitation function - Measurement of RI, RIV and excitation functions-Examples.
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.

UNIT 4: (~11 Lecture Hours)
Lightning and Switching Over-voltages: Lightning Stroke Mechanism, Probability Occurrence of Lightning Stroke Currents, General principles

of lightning protection problem, Lightning arrestors and protective characteristics, dynamic voltage rise and arrestor rating, operating characteristics of lightning arrestors. Calculation of switching surges-single phase equivalents, distributed parameter line energized by source, generalized equations for single phase representations, generalized equations for three phase systems, inverse Fourier transform for the general case, reduction of switching surges on EHV systems.

UNIT 5: (~10 Lecture Hours)
Insulation Co-Ordination in EHV Systems: Line and EHV Transformers Insulation design based on Transient Over-voltages, Flash-over and Withstand Voltages of EHV Line and Equipment Insulation, Lightning and Surge Arresters and their Protective Levels, Insulation co-ordination based on Lightning, Principle of insulation coordination on EHV power systems.

Text Books :

1. R.D.Begamudre, EHV AC Transmission Engineering, 3rd Edition, New Age International (P) Ltd, 2006.
2. M.S.Naidu, V.Kamaraju, High Voltage Engineering, 3rd Edition, Tata McGraw Hill Publication, 2005.
3. S. Rao, EHV-AC, HVDC Transmission & Distribution Engineering, Khanna Publishers, 2008.

Reference Books:

1. Allan Greenwood, Electrical Transients in Power Systems, 2nd Edition, Wiley Interscience, 1991.
2. Edison Electric Institute, EHV Transmission Line Reference Book, New York, NY in EEI Publication.

Course Outcomes:

1. To learn the relative applicational aspects of Bulk Power Transmission through EHV AC Transmission Lines.
2. Mathematically Model EHV AC Lines, the Physical phenomena & their Effects on Corona Formation, Audio, Radio, Television Interference caused by EHV Lines.
3. Learn the various Measuring Techniques & Testing Procedures applicable to EHV AC Transmission Lines & their Effects Assessment.
4. Analyze and Design EHV Systems, using the Travelling Wave Theory & Line Compensation Techniques.
5. Learn the various Testing procedures applicable to EHV AC Transmission lines & their effects assessment.
6. Analyze and design EHV systems using the Travelling Wave Theory & Line Compensation Techniques.

IV Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE118FV	**3**	**-**	**-**	**3**

POWER QUALITY AND FACTS

(Professional Elective-VI)

Prerequisites: Power Electronics

Course Objectives:

1. To understand the characteristics of ac transmission and the effect of shunt and Series reactive compensation.
2. To understand the working principles of FACTS devices and their operating characteristics.
3. To understand the basic concepts of power quality.
4. To understand the working principles of devices to improve power quality.

UNIT 1: (~6 Lecture hours)

Transmission Lines and Series/Shunt Reactive Power Compensation: Basics of AC Transmission, Reactive Power Compensation: Shunt and series compensation at the mid-point of an AC line, Comparison of Series and Shunt Compensation.

UNIT 2: (~9 Lecture hours)

Thyristor based Flexible AC Transmission Controllers (FACTS): Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Configurations/Modes of Operation, Harmonics and control of SVC and TCSC, Fault Current Limiter.

UNIT 3: (~10 Lecture hours)

Voltage Source Converter based (FACTS) controllers: Voltage Source Converters (VSC): Six Pulse VSC, Principle of Operation OF STATCOM, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC).

UNIT 4: (~8 Lecture hours)

Power Quality Problems in Distribution Systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, and Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations and flicker, Tolerance of Equipment: CBEMA curve.

UNIT 5: (~12 Lecture hours)

Custom Power Devices: Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM,

Synchronous Reference Frame Extraction of Reference Currents, Dynamic Voltage Restorer-Working Principle, Unified Power Quality Conditioner (UPQC)-Working Principle.

Text Books:

1. N. G. Hingorani, L.Gyugyi, Understanding FACTS: Concepts and Technology of FACTS Systems, Wiley-IEEE Press, 2011.
2. R.C.Dugan, Electrical Power Systems Quality, McGraw Hill Education, 2012.
3. Math H J Bollen, Understanding Power Quality Problems, IEEE Press, New Delhi, 2001.

References:

1. K.R. Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International (P) Ltd., 2016.
2. T. J. E. Miller, Reactive Power Control in Electric Systems, John Wiley and Sons, New York, 2010.
3. Bhimsingh, Ambrish Chandra, kamal AI-Haddad Power quality problems and mitigation techniques Wiley Publications, 2015.
4. G. T. Heydt, Electric Power Quality, Stars in a Circle Publications, 1991.

Course Outcomes:

At the end of the course the students will be able to

1. Apply various compensation techniques using FACTS devices.
2. Acquire knowledge on Multi level converters.
3. Apply different Pulse width modulation techniques under different operating conditions.
4. Identify the FACTs devices for different applications on system control.
5. Acquire knowledge on power quality issues.
6. Implement different custom power devices to effectively mitigate the power quality problems.

III Year B.Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: OE115KA	**3**	**-**	**-**	**3**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

FUNDAMENTALS OF DATA STRUCTURES

(Open Elective-1)

Prerequisites:-Nil-

Course Objectives:

1. Understand the basic concepts such as Linear and Non Linear Data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Understand the behavior of data structures such as stacks, queues, trees, search trees, graphs and their representations.
4. Choose the appropriate data structure for a specified application.
5. Understand and analyze various searching and sorting algorithms.

UNIT 1: (~10 Lecture Hours)

Basic concepts- Algorithm Specification, Performance Analysis- Time Complexity and Space Complexity, Asymptotic Notation-Big O, Omega and Theta notations, Introduction to Linear and Non Linear data structures. Stacks, Queues, Circular queues, Dequeue working and representation using arrays, Applications of stacks: infix to post fix conversion, postfix expression evaluation.

UNIT 2: (~9 Lecture Hours)

Linked list: Singly Linked List, Doubly Linked List, Circular linked list working and representation. Implementation of stacks and queues using linked list.

UNIT 3: (~9 Lecture Hours)

Trees: Terminology, Sequential and Linked representation, Tree traversals, Binary trees, Binary search trees, operations - insertion and Searching, m-way search trees (Definition only), B-trees-(Definition only).

UNIT 4: (~9 Lecture Hours)

Searching: Linear and binary Search methods.

Sorting: Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Heap sort, Time complexities.

UNIT 5: (~8 Lecture Hours)
Graphs: Terminology, sequential and linked representation.
Graph traversals: Depth First Search & Breadth First Search, Spanning trees, Prims and Kruskals method.

Text Books:
1. Horowitz, Sahni, and Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.
2. Mark Allen Weiss, Data Structures and Algorithms in C, 2nd Edition, Addison-Wesley.

Reference Books:
1. R.F. Gilberg and B.A. Forouzan, Data structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
2. E. Balaguru Swami, C Programming & Data structures, TMH, 2013.
3. A.M. Tanenbaum, Y. Langsam and M.J. Augensrein, Data Structures using C, 2004, Pearson Education Asia.
4. S. Lipscutz and Schaum's Outline Data Structures, TMH, July 2017.
5. R. Thareja, Data Structures using C, Oxford University Press, October 2015.

Online Resources:
1. www.cise.ufl.edu/~sahni/dsaac.
2. www.geeksforgeeks.org/data-structures
3. https://www.tutorialspoint.com
4. https://onlinecourses.nptel.ac.in/
5. https://www.coursera.org/

Course Outcomes:
After completion of the course, students will be able to
1. Analyse the time and space complexities of algorithms.
2. Differentiate between linear and non-linear data structures.
3. Use basic data structures such as linked list, stack and queue for data representation.
4. Understand advanced data structures like binary trees, search trees and graphs.
5. Choose appropriate data structures to represent data items in real world problems.
6. Analyse various kinds of searching and sorting techniques.

III Year B.Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: OE115KB	**3**	**-**	**-**	**3**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

JAVA PROGRAMMING

(Open Elective-1)

Prerequisites:-Nil-

Course Objectives:

1. Learn the concepts of object oriented programming.
2. Introduce the implementation of inheritance, packages and interfaces.
3. Understand the concepts of exception handling and multithreading.
4. Introduce the java collection framework and I/O classes.
5. Gain knowledge in designing Graphical User Interface using applets and swing controls.

UNIT 1: (~8 Lecture Hours)

OOP concepts: Data Abstraction, Encapsulation, Inheritance, Polymorphism, Classes and Objects, Procedural and Object oriented programming paradigms.

Java Basics: History of Java, Java buzzwords, Data types, Variables, Arrays, operators, expressions, control statements, Introducing classes, Methods, Constructors, Inner classes, Anonymous Inner classes, String handling.

UNIT 2: (~8 Lecture Hours)

Inheritance: Inheritance concepts, Member access, Creating Multilevel hierarchy, using super, using final with inheritance, forms of inheritance, benefits of inheritance, costs of inheritance, Polymorphism, method overriding, abstract classes, Object class.

Packages: Defining a Package, CLASSPATH, Access Protection, Importing packages.

Interfaces: Defining an Interface, implementing Interfaces, Nested interfaces, Variables in interfaces and Extending Interfaces.

UNIT 3: (~8 Lecture Hours)

Exception handling: Fundamentals of Exception Handling, Exception Types, Using try and Catch, multiple Catch Clauses, Nested Try statements, Throw, Throws and finally, built-in exceptions, creating own exception sub classes.

Multithreading: Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT 4: (~8 Lecture Hours)

Stream based I/O (java.io): The Stream classes - Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing files, Random access file operations, Generics, Enumerations.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Iterator, Stack, Vector, String Tokenizer, Scanner.

UNIT 5: (~ 10 Lecture Hours)

Event Handling: The Delegation Event Model - Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes.

GUI Programming with Swing: Introduction, limitations of AWT, MVC architecture, Swing components, Swing containers, Swing Controls - JLabel, JTextField, JButton, JToggleButton, JCheckBox, JRadioButton, JTabbedPane, JScrollPane, JList, JComboBox, Swing Menus, Dialogs. Layout Managers- FlowLayout, BorderLayout, GridLayout, CardLayout, GridBagLayout.

Applets: The Applet class, Difference between Applets and Applications, Life Cycle of an Applet, passing parameters to applets.

Text Books:

1. Herbert Schildt, Java- The Complete Reference, 9th Edition, McGraw Hill Education (India) Pvt. Ltd.
2. Herbert Schildt and Dale Skrien, Java Fundamentals - A comprehensive Introduction, McGraw Hill Education (India) Pvt. Ltd., 2013.

Reference Books:

1. Jaime Nino and Frederick. A. Hosch, An Introduction to Programming and Object Oriented Design using Java, John Wiley & sons, 2013.
2. Timothy Budd, Understanding Object-Oriented Programming with Java, updated Edition, Pearson Education.
3. Y. Daniel Liang, Introduction to Java Programming, Comprehensive Version, 7th Edition, Pearson Education.
4. P. Radha Krishna, Object Oriented Programming through Java, Universities Press 2008.

Online Resources:

1. https://docs.oracle.com/javase/tutorial/java/TOC.html
2. www.javatpoint.com/java-tutorial

3. https://onlinecourses.nptel.ac.in/
4. https://www.coursera.org/

Course Outcomes:

After completion of the course, students will be able to

1. Understand the object oriented programming concepts and solve real world problems.
2. Demonstrate the use of inheritance and packages.
3. Understand and implement the concepts of exception handling.
4. Develop multithreaded applications with synchronization.
5. Solve problems using java collection framework and I/O classes.
6. Design Graphical User Interface using applets and swing controls.

III Year B.Tech. I-Semester **L T P C**
Course Code: OE115KC **3 - - 3**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING/
DEPARTMENT OF ELECTRONICS AND TELEMATICS ENGINEERING

BASIC ELECTRONICS

(Open Elective-1)

Prerequisite:-Nil-

Course Objectives:

1. To review the basic concepts of semiconductor physics.
2. To understand the concept of electronic devices, circuits and their applications.
3. To explore the construction, operation and characteristics of various electronic devices like diodes, transistors (BJTs and FETs).
4. To distinguish between various special purpose diodes.

UNIT 1: (~10 Lecture Hours)
P-N Junction Diode: Volt-Ampere characteristics, Ideal versus practical, Static and dynamic resistances, Equivalent circuits, Load line analysis, Applications of pn Diode.
Break down Mechanisms-Avalanche breakdown, Zener breakdown and its applications.
Rectifiers: P-N junction as a rectifier - Half Wave Rectifier, Full Wave Rectifier: performance parameters.

UNIT 2: (~ 10 Lecture Hours)
Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector configurations.
Transistor Biasing And Stabilization: Operating point, DC & AC load lines, Biasing Voltage divider bias.

UNIT 3: (~10 Lecture Hours)
Field Effect Transistors: JFET Construction and Principle of operation, Symbol, Pinch-Off Voltage, Volt-Ampere Characteristic, MOSFET characteristics (Enhancement and depletion mode), Symbols of MOSFET, Comparison of BJT and FET, Introduction to CMOS circuits.

UNIT 4: (~10 Lecture Hours)
Small Signal Low Frequency Model of BJT: BJT modeling, Hybrid model, Determination of h-parameters from transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters, low

frequency response of BJT Amplifiers, effect of coupling and bypass capacitors, Comparison of CE, CB and CC configurations.

UNIT 5: (~08 Lecture Hours)
Special purpose Diodes: Opto-Electronic Devices – LEDs, Photo Diode and Applications, Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications.

Text Books:

1. J.Millman, C.C.Halkias, and Satyabratha Jit, "Electronic Devices and Circuits", 2nd Edition, Tata McGraw Hill, 2007.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", 9th Edition, Pearson/Prentice Hall, 2006
3. T.F. Bogart Jr., J.S.Beasley and G.Rico," Electronic Devices and Circuits", 6th Edition, Pearson Education, 2004.

Reference Books:

1. S.G.Burns and P.R.Bond, Principles of Electronic Circuits, 2nd Edition, Galgotia Publications, 1998.
2. Millman and Grabel, Microelectronics, Tata McGraw Hill, 1988.
3. G. Streetman and S. K. Banerjee, Solid State Electronic Devices, 7th Edition Pearson, 2014.
4. C.T. Sah, "Fundamentals of Solid State Electronics", World Scientific Publishing Co. Inc, 1991.

Online Resources:

1. http://www.radio-electronics.com
2. https://users.encs.concordia.ca/~rabinr
3. https://circuitdigest.com/electronic-circuits
4. -NPTEL
5. -edX

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Illustrate the fundamental behaviour of various diodes, transistors.
2. Explain the construction, operation and characteristics of BJT, JFET and MOSFET.
3. Analyse the various amplifier circuits using small signal hybrid model.
4. Identify the necessity for biasing.
5. To know the operation of various special purpose devices like LED, Photo diode and SCR.
6. Apply the knowledge of Diodes in designing circuits like rectifiers.

III Year B.Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: OE115KD	**3**	**-**	**-**	**3**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRICAL MATERIALS

(Open Elective-1)

Prerequisite:-Nil-

Course Objectives:

1. To impart knowledge on the concepts of Dielectric electric materials in comparison with magnetic materials.
2. To introduce special purpose materials.
3. To make students familiar with the concepts of different materials for electrical applications.
4. To familiarize students with the internal concepts of electrical materials.

UNIT 1: (~10 Lecture Hours)

Dielectric and Semiconductor 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, in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials.

Semiconductors: Intrinsic, Extrinsic types, Current carriers in semiconductor, Thermistors, Photoconductors, P-N junction Diode, Evolution of transistor.

UNIT 2: (~8 Lecture Hours)

Magnetic Materials: Classification of magnetic materials, properties of ferromagnetic materials, curie point, 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 3: (~8 Lecture Hours)

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.

UNIT 4: (~8 Lecture Hours)

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. Piezoelectric materials, Pyroelectric materials.

UNIT 5: (~8 Lecture Hours)

Materials for Specific Applications : Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings.

Sintered alloys for breaker and switch contacts.

Text Books:

1. R K Rajput, A course in Electrical Engineering Materials, Laxmi Publications, 2009.
2. C S Indulkar and S Thiruvengadam, An introduction to Electrical Engineering Materials, Revised Edition, S. Chand & Company, 2013.
3. T K Basak, A course in Electrical Engineering Materials, New Age Science Publications, 2009.

Reference Books:

1. A.J. Dekker, Electrical Engineering Materials, PHI Publication, 2006.
2. TTTI Madras, Electrical Engineering Materials, McGraw Hill Education, 2004.

Course Outcomes:

At the end of the course the students will be able to

1. Distinguish between magnetic and non-magnetic materials by acquiring the knowledge of their atomic structures.
2. Analyse Dielectric and semiconductor materials.
3. Analyse the magnetic materials using their properties.
4. Identify special purpose materials for different applications.
5. Analyse the working of different materials from the point of view of their applications in electrical industry.
6. Analyse the working of special purpose materials from the point of view of their possible applications electrical & other fields.

III Year B.Tech. I-Semester / II-Semester	**L**	**T**	**P**	**C**
Course Code: OE115KE / OE116KE	**3**	**-**	**-**	**3**

DEPARTMENT OF MECHANICAL ENGINEERING

OPERATIONS RESEARCH

(Open Elective -1 / Open Elective-2)

Prerequisites:-Nil-

Course objectives:

1. Study the linear programming and dynamic programming techniques used for business and engineering applications.
2. Know about the inventory, Game theory and replacement theory applications in real world.

UNIT 1: (~8 Lecture Hours)

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem-Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M methods, Special cases in LP-Degeneracy, unbounded, infeasibility & alternative optima

UNIT 2: (~8 Lecture Hours)

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions-Northwest corner rule, Least cost method and Vogel's approximation method. Optimality test by MODI method & stepping stone method.

UNIT 3: (~8 Lecture Hours)

Assignment Model: Formulation, Hungarian method for optimal solution. Solving unbalanced Assignment problem.

Sequencing Models. Solution of sequencing Problem-Processing n jobs through 2 Machines-Processing n jobs through 3 Machines-Processing n jobs through m Machines. Processing 2 jobs through m-machines.

UNIT 4: (~8 Lecture Hours)

Dynamic Programming: Characteristics of Dynamic programming. Dynamic Programming approach for Coach/Shortest Path and cargo loading problems.

Inventory Models: Inventory costs. Models with deterministic demand-Model (a) Demand rate uniform and production rate infinite, Model (b) Demand rate uniform and production rate finite.

UNIT 5: (~8 Lecture Hours)

Games Theory: Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, and value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point-mixed strategy for 2*2 games.

Replacement Models: Replacement of items that deteriorate whose maintenance costs increase with time without change in the money value, Replacement of items that fail suddenly: Individual Replacement policy, Group Replacement policy.

Text Books:

1. P.SankaraIyer, Operations Research, Tata Mcgraw-Hill, 2008.
2. A.M. Natarajan, P. Balasubramani and A.Tamilarasi, Operations Research, Pearson Education, India, 2012.
3. Hamdy A Taha, Operations Research an Introduction, Pearson Education, 2010.

Reference Books:

1. S.D. Sharma, Operations Research Theory Methods and Applications, Kedarnath Ramnath Publishers, 2015.
2. P. K. Gupta and D. S. Hira, Operations Research, S. Chand & Co., 2014.
3. J K Sharma, Operations Research Problems and Solutions, 3rd Edition, Macmillan India Ltd, 2008.

Online Resources:

1. IOR Tutorials(Interactive Operations Research Tutorial)
2. http://www.nptel.ac.in

Course Outcomes:

After completion of the course, students will be able to

1. Apply linear programming models to several Engineering Applications.
2. Use several other techniques like Transportation, Assignment and Sequencing Models in the real world applications.
3. Study selected Dynamic Programming models for real world situations.
4. Apply simple mathematical models in Inventory into the real Engineering Applications.
5. Solve Game theory problems related to business applications.
6. Develop optimum replacement policy.

III Year B.Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: OE115KF	**3**	**-**	**-**	**3**

DEPARTMENT OF HUMANITIES & MATHEMATICS

INTRODUCTION TO DATA ANALYTICS

(Open Elective -1)

Prerequisites:-Nil-

Course Objectives:

1. To learn the importance of Probability and Statistics
2. To know about the Regression
3. To gain a basic knowledge on Supervised and Unsupervised Learning
4. To study the concepts of Time Series Analysis

UNIT 1: (~9 Lecture Hours)
Descriptive Statistics: Role of data analytics in science and engineering, different types of data and data Summarization methods; Measures of central tendency & measure of dispersion; Probability - Conditional probability, Baye's theorem. Random variables - Discrete, continuous probability distributions, expectations and variance.

UNIT 2: (~ 9 Lecture Hours)
Regression: Linear regression - Estimating co-efficient, assessing the accuracy of co-efficient estimates, assessing accuracy of the model. Multiple linear regression- Estimating co-efficient, relation between response and predictors, marketing plan comparison of linear regression with K-nearest neighbor.

UNIT 3: (~9 Lecture Hours)
Supervised Learning: Classification - Overview, logistic regression, multiple logistic regressions, linear discriminant analysis, Baye's theorem for classification, quadratic discriminant analysis, comparison of classification methods.

UNIT 4: (~9 Lecture Hours)
Unsupervised Learning: Associative rules - Generating candidate's rules, the Apriori algorithm, support and confidence, lift ratio, the process of rule selection and interpreting results.

Clustering- measuring distances between two records, measuring distances between two clusters, hierarchical (Agglomerative) clustering, non-hierarchical clustering, K-means algorithm.

UNIT 5: (~9 Lecture Hours)
Time Series Analysis: Introduction, significance of time series analysis,

components of time series, secular trend, freehand of graphic method, semi-average method, method of moving averages, method of least squares, straight linear and non-linear trends, logarithmic methods, exponential trends, growth curves, seasonal variation, method of simple averages, ratio-to-trends, ratio-to-moving average method.

Text Books:

1. S.P.Gupta, Statistical Methods, 33rd Edition, Sultan - Chand & Sons.
2. Galit Shmueli, Peter C. Bruce, Inbal Yahav, Nitin R. Patel and Kenneth C. Lichtendahl Jr., Data Mining For Business Analytics Concepts, Techniques, and Applications in R, Wiley Publications.
3. Hastie and Trivor, et al., The Elements of Statistical Learning. Vol.2, No.1.Newyork, Springer, 2009.

Reference Books:

1. Montgomery, Douglus C., and George C.Runger. Applied Statistics and Probability for Engineers John Wiley & Sons. 2010.
2. Tang-Ning-Tan, Micheal-Steinbach, Vipin Kumar, Anuj Karpatne, Introduction to Data Mining, Pearson India Education Services Ltd, 2016.
3. Roxy Peck, San Luis Obispo and Iowa Jay L. Devore, Introduction to Statistics and Data Analysis, 5th Edition, Cengage Learning.

Online Resources:

1. onlinelibrary.wiley.com
2. nptel.ac.in/courses/Introduction to Data Analytics

Course outcomes:

After completing the course the student will be able to

1. Understand the definitions and concepts associated with central tendency and measures of dispersion.
2. Find the probability of an event and know the properties of distribution.
3. Determine the regression co-efficient and test the accuracy of co-efficient.
4. Learn basic concepts in supervised learning.
5. Attain basic knowledge in unsupervised learning.
6. Understand past behavior of data and forecast the future behavior using time series analysis.

III Year B.Tech. I-Semester/II-Semester	**L**	**T**	**P**	**C**
Course Code: OE115KG / OE116KG	**3**	**-**	**-**	**3**

DEPARTMENT OF HUMANITIES & MATHEMATICS

INTELLECTUAL PROPERTY RIGHTS

(Open Elective -1 / Open Elective-2)

Prerequisites:-Nil-

Course Objectives:

1. To educate the importance of IPR in Engineering
2. To enlighten the various types of IP's and their protection.
3. To maintain IPR's for Business sustainability.

UNIT 1: (~9 Lecture Hours)

Introduction to Intellectual property

Intellectual property: Introduction-Features-Types of Intellectual property - International organizations - Agencies and treaties, Conventions -Importance of Intellectual property rights.

UNIT 2: (~8 Lecture Hours)

Patents: Concept of Patent -Duration -Patent Process -Patent searching process-Procedure for filling Application of Patents - Ownership, Transfer, Assignment and Licensing of Patent-Remedies for Infringement of Patents.

UNIT 3: (~10 Lecture Hours)

Copyrights and Trademarks

Copyrights-Fundamental of Copy right law - Originality of material- Rights of Reproduction - Rights to perform the work publicly - Copyright Ownership issues - Copyright registration - Notice of Copyright - Remedies for infringement in Copyrights.

Trademarks-Purpose and functions of Trademarks-Acquisition of Trademark rights - Protectable matter - Selecting and evaluating Trademark - Trademarks registration process -Remedies for infringement in Trade marks.

UNIT 4: (~8 Lecture Hours)

Industrial Designs: Assignment of Design – Essential requirement of Registration-Registration Process of Industrial Designs – Benefits of registration-Assignment, Transmission and Licensing of Industrial Designs - Remedies for infringement of Designs.

UNIT 5: (~10 Lecture Hours)

Trade Secrets: Trade secret law -determinants of Trade secret status - Liability for misappropriations of Trade Secrets -Protection for submission - Trade secret litigation-Unfair competition – Interface between Intellectual Property Rights and Competition – Safeguards against Unfair competitions.

Intellectual property audits: Types of IP Audit – Procedure of Preparing Audit – Auditing IP Assets.

Text Books:

1. Deborah. E. Bouchoux, Intellectual property right, 1st Edition, Cengage learning, 2015.
2. Prabuddha Ganguli, Intellectual property right-Unleashing the knowledge economy, 1st Edition , Tate McGraw Hill Publishing company Ltd., 2015.

Reference Books:

1. Kompal Bansal and Parikshit Bansal, Fundamentals of Intellectual property for Engineers, 1st Edition, BS Publications, 2015.

Online Resources:

1. https://www.icsi.edu/media/webmodules/publications/9.4%20Intellectual%20Property%20Rights.pdf
2. Introduction on Intellectual Property to Engineers and Technologists https://nptel.ac.in/courses/109105112/

Course Outcomes:

After completion of the course the student will be able to

1. Understand the dynamics and legalistic framework of IPR's
2. Acquaint with securing patents and its protection.
3. Seize the dimensions of Copy right protection.
4. Realize the eminence of Trade Marks in growth of business.
5. Essentials of safeguarding Industrial designs.
6. Sustentation of Trade Secrets and aspects of IP audit.

III Year B.Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: OE115KH	**3**	**-**	**-**	**3**

DEPARTMENT OF BASIC SCIENCES

DISASTER MANAGEMENT

(Open Elective -1)

Prerequisites:-Nil-

Course Objectives:

1. To understand the critical concepts in Disaster Management.
2. To gain the knowledge on the factors responsible for cause of various disasters.
3. To provide the information on different disasters, tools and methods for disaster management.
4. To provide an overview on the roles of Government and non-government agencies in disaster management.

UNIT 1: (~9 Lecture Hours)

Understanding Hazards and Disaster: Introduction – Environmental Hazard, Environmental Disaster and Environmental Stress. Concept of Disaster-Concept of Risk. Different approaches in Disaster Management. Levels of Disasters. Disaster Phenomena and Events (Global, National and Regional).

Hazards and Vulnerabilities: Classification of Hazards and Disasters - Natural and Man-made Hazards (Planetary, Extra Planetary, Endogenous and Exogenous Hazards). Characteristics and damage potential of natural hazards. Hazard assessment. Dimensions of vulnerability factors, vulnerability assessment and disaster risk. Vulnerabilities to flood and earthquake hazards.

UNIT 2: (~9 Lecture Hours)

Planetary and Extra Planetary Hazards: Endogenous Hazards and Exogenous Hazards. **Earthquake Hazards and disasters** - Causes of Earthquakes, distribution of earthquakes, Hazardous effects of earthquakes, Earthquake Hazards in India, Human adjustment, perception and mitigation of earthquake.

Cyclones - Causes, Effects, distribution, human adjustment, perception and mitigation of Cyclones.

Cumulative Atmospheric Hazards and Disasters: Floods, Droughts, Cold waves and Heat waves.

Floods - Causes of floods, Effects of Floods, Flood hazards in India, Flood control measures, Human adjustment, perception and mitigation.

Droughts – Causes of Droughts, Impacts of droughts, Drought hazards in India, Drought control measures. Extra Planetary Hazards and Disasters - man induced Hazards and Disasters - Physical hazards and Disasters.

UNIT 3: (~8 Lecture Hours)
Disaster Management Mechanism: Concepts of risk management and crisis management. Disaster Management Cycle – Prevention, Mitigation, Preparedness, Response, Recovery and Rehabilitation. Planning for Relief.

UNIT 4: (~9 Lecture Hours)
Capacity Building & Coping with Disaster: Capacity Building: Concept, Structural and Nonstructural measures, Capacity assessment, Strengthening Capacity for Risk Reduction. Legislative support at State and National levels. Case Studies.

Coping Strategies: Alternative adjustment processes, changing concepts of disaster management. Industrial Safety Plan - Safety norms and survival kits. Role of Mass media in disaster management. Crowd Management.

UNIT 5: (~9 Lecture Hours)
Planning for Disaster Management: Strategies planning for disaster management, steps for formulating reduction in disaster risk. Disaster Management Act and Policy in India – Organizational structure for disaster management. Preparation of state and district level disaster management plans. Sendai Framework on Disaster Risk Reduction (DRR). Use of latest technologies – Remote Sensing (RS) and Geological Information System (GIS).

Text Books:

1. Manual on Disaster Management, National Disaster Management Agency, Govt of India.
2. Mrinalini Pandey, Disaster Management, 1st Edition, Wiley, 2014.
3. T. Bhattacharya, Disaster Science and Management, McGraw Hill Education (India) Private Limited, 2015.
4. Pradeep Sahni, Disaster Mitigation: Experiences and Reflections PHI Learning Private Limited, 2010.
5. Donald Hyndman and David Hyndman, Natural Hazards and Disasters, Cengage Learning, 2006.

Reference Books:

1. N. Pandharinath and CK Rajan, Earth and Atmospheric Disasters Management, BS Publications, 2009.
2. R. B. Singh, Environmental Geography, Heritage Publishers, New Delhi, 1990.

3. Savinder Singh, Environmental Geography Prayag Pustak Bhawann, 1997.
4. B. I. Kates and G. F. White, The Environment as Hazards, Oxford Press, New York, 1978.
5. R. B. Singh, Disaster Management, Rawat Publication, New Delhi, 2000.
6. H. K. Gupta, Disaster Management Universities Press, India, 2003.
7. R. B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994.
8. Satender, Disaster Management in Hills Concept Publishing Co., New Delhi, 2003.
9. R. K. Bhandani, An Overview on Natural and Manmade Disaster and their Reduction, CSIR, New Delhi.
10. M. C. Gupta, Manuals on Natural Disaster Management in India, National Centre for Disaster Management, IIPA, New Delhi, 2001.

Online Resources:

1. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf).
2. National Institute of Disaster Management (NIDM) (https://nidm.gov.in)
3. WHO-Disaster Management Resources-https://www.who.int/surgery/publications/immesc_disaster_management/en/
4. https://swayam.gov.in/courses/4983-disaster-management
5. https://reliefweb.int/training/2455444/free-online-course-disaster-risk-reduction-and-management
6. https://www.unisdr.org/we/inform/events/47107
7. https://www.futurelearn.com/courses/disaster-management/2
8. https://www.ifrc.org/en/get-involved/learning-education-training/certified-professional-development-courses/online-certificate-programme-in-disaster-management/

Course Outcomes:

After completion of the course, students will be able to

1. Understand different kinds of disasters and their vulnerabilities.
2. Identify the causes, effects and mitigation measures of different disasters.
3. Apply the disaster management mechanism in natural and man induced calamities.
4. Analyse and solve the unforeseen situations with advanced technologies like Remote Sensing and Geological Information Systems.

III Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: OE116KJ	**3**	**-**	**-**	**3**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

OPERATING SYSTEMS

(Open Elective-2)

Prerequisites:-Nil-

Course Objectives:

1. To understand the role of OS in the overall computer system and study the operations performed by OS as a resource manager.
2. To understand the scheduling policies and different memory management techniques for different operating systems.
3. To understand process concurrency and synchronization.
4. To understand the concepts of I/O, storage and file management and introduce system call interface for file and process management.
5. To introduce the goals and principles of protection.

UNIT 1: (~10 Lecture Hours)

Introduction: 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 2: (~9 Lecture Hours)

Process: Process concepts-The Process, Process State, Process State transitions, Process Control Block, Context Switch.

Threads: Definition, Various states, Benefits of threads, Types ofthreads, Concept of multithreads.

Process Scheduling: Scheduling Queues, Schedulers, Scheduling Criteria, Scheduling algorithms, Multiprocessor Scheduling. Case Studies: Linux, Windows.

UNIT 3: (~10 Lecture Hours)

Process Synchronization: Inter-process Communication: Background, The Critical Section Problem, Race Conditions, Mutual Exclusion, Peterson's solution, Synchronization Hardware, Semaphores, Classic

Problems of Synchronization- Bounded Buffer Problem, The Producer/ Consumer Problem, Reader's & Writer Problem, Dinning Philosopher Problem, Event counters, Monitors, Message passing.

Deadlocks: Deadlocks - System Model, Deadlock Characterization: Necessary and sufficient conditions for Deadlock, Methods for Handling Deadlocks: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT 4: (~10 Lecture Hours)

Memory Management: Basic Hardware, Address Binding, Logical and physical address space, Dynamic loading, linking and Shared libraries, Swapping, Contiguous Memory Allocation- Fixed and variable partition– Internal and External fragmentation and Compaction; Segmentation, Paging- Hardware support for paging, Protection, shared pages, Structure of Page Table. Case Studies: Linux, Windows

Virtual Memory Management: Background, Demand Paging-locality of reference, Page fault; Copy-on-Write, Page replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT 5: (~9 Lecture Hours)

File Management: Concept of File - Attributes, operations, file types, internal structure, access methods, Directory structure, file protection, file System structure, Allocation methods (contiguous, linked, indexed),Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk formatting- Boot-block, Bad blocks.

Protection: System Protection, Goals of Protection, Principles of Protection.

Text Books:

1. Abraham Silberschatz, Peter B.Galvin and Greg Gagne, Operating System Concepts, 9th Edition, Wiley Asia Student Edition.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hall of India.

Reference Books:

1. Charles Crowley, Operating System: A Design-oriented Approach, 1st Edition, Irwin Publishing.
2. Gary J. Nutt and Addison, Operating Systems: A Modern Perspective, 2nd Edition, Wesley.

3. Maurice Bach, Design of the Unix Operating Systems, 8th Edition, Prentice Hall of India.
4. Daniel P. Bovet and Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly and Associates.

Online Resources:

1. Abraham-Silberschatz-Operating-System-Concepts—9th 2012.12.pdf
2. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/

Course Outcomes:

After completion of the course, students will be able to

1. Acquire a High-level understanding of what is an operating system and the role it plays and the services it provides.
2. Understand process management concepts including scheduling, synchronization.
3. Describe System model for deadlock, Methods for handling deadlocks.
4. Understand of memory management including virtual memory.
5. Acquire Knowledge on issues related to file system interface and implementation.
6. Understand the issues related to disk management.

III Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: OE116KK	**3**	**-**	**-**	**3**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

DATABASE MANAGEMENT SYSTEMS

(Open Elective-2)

Prerequisites:-Nil-

Course Objectives:

1. To understand the basic concepts and the applications of database systems.
2. To master the basics of SQL and construct queries using SQL.
3. To understand the relational database design principles.
4. To become familiar with the basic issues of transaction processing and concurrency control.
5. To become familiar with database storage structure and recovery mechanisms.

UNIT 1: (~10 lecture Hours)

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational schemas, Entity-Relationship Design Issues, Extended E-R Features.

UNIT 2: (~9 lectures Hours)

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Schema Diagrams. The Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus.

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries.

UNIT 3: (~10 lectures Hours)

Advanced SQL: Join Expressions, Views, Integrity Constraints, Triggers.
Normalization: Functional Dependencies, Lossless decomposition, 1NF, 2NF, 3NF, Dependency Preservation, BCNF, Multi–valued dependencies, 4NF, Join Dependencies, 5NF.

UNIT 4: (~10 lecture Hours)
Transaction Management: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

Concurrency Control: Lock-Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.

UNIT 5: (~9 lecture Hours)
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Failure with loss of non-volatile storage, Remote Backup systems.

Indexing: Ordered Indices, B+ -Tree Index files.

Text Books:
1. A. Silberschatz, Henry. F. Korth and S. Sudarshan, Data base System Concepts, 6th Edition, McGraw Hill Education (India) Private Limited.
2. C. J. Date, A. Kannan and S. Swami Nadhan, An Introduction to Database systems, 8th Edition, Pearson Education.

Reference Books:
1. Raghu Ramakrishnan and Johannes Gehrke, Data base Management Systems, 3rd Edition, McGraw Hill Education (India) Private Limited.
2. R Elmasri and Shamkant B. Navathe, Database Systems, 6th Edition, Pearson Education.

Online Resources:
1. https://www.w3schools.in/
2. https://www.tutorialspoint.com/
3. https://beginnersbook.com/2015/04/dbms-tutorial/
4. https://www.coursera.org/courses?query=database
5. https://onlinecourses.nptel.ac.in/noc18_cs15
6. https://online.stanford.edu/course/databases-self-paced

Course Outcomes:
After the completion of the course, students will be able to
1. Understand concepts and the applications of database systems and ability to implement in real time applications.
2. Construct an Entity-Relationship (E-R) model from specifications and transform to relational model.
3. Demonstrate the basic concepts of relational database management system and construct unary/binary/set/aggregate queries in Relational Algebra and in SQL.
4. Apply normalization on database.
5. Understand principles of database transaction management.
6. Understand the storage and recovery of database

III Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: OE116KL	**3**	**-**	**-**	**3**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING/
DEPARTMENT OF ELECTRONICS AND TELEMATICS ENGINEERING

PRINCIPLES OF ELECTRONIC COMMUNICATIONS

(Open Elective -2)

Prerequisites:-Nil-

Course Objectives:

1. Introduce the students to modulation and various analog modulation schemes.
2. Distinguish between Pulse, Analog and Digital Communication systems.
3. Analyse the concepts of satellite, optical communications.
4. Understand and compare cellular and telecommunication system concepts.

UNIT 1: (~08 Lecture Hours)
Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT 2: (~10 Lecture Hours)
Simple description on Modulation: Analog Modulation- Amplitude Modulation Fundamentals, Amplitude Modulator and Demodulator Circuits, Fundamentals of Frequency Modulation, Transmission of Binary data in communication system-Principles of Digital transmission, Transmission efficiency, modern concepts, wide band modulation.

UNIT 3: (~10 Lecture Hours)
Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

UNIT 4: (~10 Lecture Hours)
Optical Communication: Optical Principles, Optical Communication Systems, Fiber-Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT 5: (~10 Lecture Hours)
Telecommunication Systems: Telephones Telephone system, Facsimile,

Internet Telephony. Cellular Communications: Cell phone technologies-Cellular telephone systems, Mobile phone systems, Digital cell phone systems(2G,2.5G,UMTS 3G,4G).

Text Books:

1. Louis E. Frenzel -Principles of Electronic Communication Systems, 3rd Edition, McGraw Hill publications, 2008.

Reference Books:

1. Theodore S. Rappaport, Wireless Communications-Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2nd Edition, Wiley Publications.

Online Resources:

1. https://nptel.ac.in/courses/108104098/

Course Outcomes:

After completion of the course, students will be able to

1. Analyze the basic concepts of modulation and understand the different kinds of analog modulation techniques.
2. Understand and analyze the different types of pulse analog and digital modulation systems.
3. Describe the Telephone systems and network fundamentals.
4. State the operative physical principle of launching satellites and explain the concept & operation of GPS.
5. Comprehend about the principle of optical communication system, functioning of optical cables and wave division multiplexing.
6. Describe the cell phone operational concepts.

III Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: OE116KM	**3**	**-**	**-**	**3**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

RENEWABLE ENERGY SOURCES

(Open Elective-2)

Prerequisites:-Nil-

Course Objectives:

1. Various renewable energy resources available at a location and assessments of its potential, using tools and techniques.
2. Solar energy radiation, its interactions, measurement and estimation
3. Site selection for wind turbines, wind systems, measurements and instrument
4. Geothermal, wave, tidal and OTEC resources, site selection

UNIT 1: (~6 Lecture Hours)

Introduction To Renewable Energy Sources: Definition, Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES, Classification of NCES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of these energy sources.

Solar energy: Solar radiation spectrum - Extraterrestrial and terrestrial solar radiation, solar constant -Radiation measurement - Instruments for measuring solar radiation and Sun shine, solar radiation data.

UNIT 2: (~10 Lecture Hours)

Solar Energy Collection, Storage and Applications: Energy Collection: Flat plate and Concentrating collectors, their performance analysis and Classification of Concentrating collectors,

Energy Storage: Sensible heat, Latent heat, Stratified storage - Solar ponds. Applications: Heating techniques, Cooling techniques, Solar Distillation and Drying,

Solar Photovoltaic Generation: PV Generation, Photovoltaic energy conversion – Operating principle, Photovoltaic cell concepts, Cell, module, array, Series and parallel connections, Potential of India in Solar energy utilization.

UNIT 3: (~10 Lecture Hours)

Wind Energy and Biomass: Wind energy: Power in Wind, Betz criteria, Site selection, Types of wind mills, Characteristics of wind generators, Potential of India in Wind Energy utilization.

Bio-mass: Principles of Bio-Conversion, Anaerobic, Aerobic digestion, Types of Bio-gas digesters, Pyrolysis, Applications - Bio gas, Wood stoves, Bio diesel, Economic aspects.

UNIT4: (~8 Lecture Hours)
Geothermal Energy And Ocean Energy: Geothermal energy: Resources, Methods of harnessing the energy-Introduction to Thermo dynamic Cycles- Potential of India in Geothermal energy options.

Ocean energy: OTEC - Principle of utilization, setting up of OTEC plants, Thermodynamic cycles involved in OTEC. Tidal and wave energy – Potential and conversion techniques, Mini-hydel power plants and their economics in India.

UNIT 5: (~8 Lecture Hours)
Direct Energy Conversion: Direct Energy Conversion (DEC), Need for DEC, Types of DEC - Fuel Cells, working of hydrogen fuel cell Magneto Hydro Dynamic Energy Conversion (MHD), Thermo Electric and Thermo Ionic Conversion (elementary treatment only), Working Principle, Advantages and Disadvantages. Combined cycle and Co-generation.

Text Books:
1. G.D. Rai, Non-Conventional Energy Sources, 5th Edition, Khanna Publishers, 2009.
2. D.P.Kothari, K.C.Singhal and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, 2nd Edition, P.H.I., 2014.
3. Twidell & Wier, Renewable Energy Resources, 3rd Edition, CRC Press (Taylor & Francis), 2006.

Reference Books:
1. Tiwari, Ghosal, Renewable Energy Resources, Narosa Publications, 2005.
2. Sukhatme.S.P, Solar Energy: Principles of Thermal Collection and Storage, 3rd Edition, Tata McGraw Hill, 2008.

Course Outcomes
After completion of this course the students should able to
1. Estimate the solar energy, Utilization of solar energy, Principles involved in solar energy collection and conversion of it to electricity generation
2. Explore the concepts involved in wind energy conversion system by studying its components, types and performance
3. Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
4. Acquire the knowledge on Geothermal energy and it's harnessing methods
5. Illustrate ocean energy and explain the operational methods of their utilization.
6. Describe the concept of direct energy conversion and their types and working principle

III Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: OE116KN	**3**	**-**	**-**	**3**

DEPARTMENT OF MECHANICAL ENGINEERING

RESEARCH METHODOLOGY

(Open Elective-2)

Prerequisites:-Nil-

Course objectives:

1. To develop an understanding towards basic concepts of the research methodology.
2. To familiarize primary disparity between quantitative research and qualitative research.
3. To provide knowledge to define appropriate research problem and its parameters.
4. To familiarize tools and techniques used for preparation of report writing.

UNIT 1: (~10 Lecture Hours)

Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Importance of Research Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

UNIT 2: (~8 Lecture Hours)

Defining the Research Problem: Definition of Research Problem, selecting the Problem, Necessity of Defining the Problem, Technique involved in Defining a Problem.

Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of

Quality of Journals and Articles, Information through Internet. Literature Review: Need of Review, Guidelines for Review, Record of Research Review.

UNIT 3: (~8 Lecture Hours)

Research Design: Meaning of Research Design, Need for Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design.

Design of Sample Surveys: Sample Design, Sampling and Non Sampling Errors, Sample Survey Versus Census Survey. Types of Sampling Designs: Non Probability Sampling, Probability Sampling.

UNIT 4: (~8 Lecture Hours)

Data Collection and Preparation: Collection of Primary data: Observation method, Interview method, Questionnaires, Schedules. Collection of Secondary data, Case study method.

Data Preparation:Questionnaire checking, Editing, Coding, Classification, Tabulation.

Graphical Representation: Pie chart, Bar chart, Histogram, Frequency Polygon.

UNIT 5: (~8 Lecture Hours)

Interpretation and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Precautions of interpretation. Significance of Report Writing, Steps in Writing the Report, Format of the Research Report. Technical paper writing/Journal paper writing, Making Presentation, Use of Visual Aids, Elementary Treatment of Plagiarism Tools.

Text Books:

1. C.R Kothari & Gaurav Garg, Research Methodology, Methods & Technique, New Age International Publishers, 2019.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2016.

Reference Books:

1. R .Pannerselvam, Research Methodology, Prentice hall of India, 2014.
2. Ratan Khananabis and Suvasis Saha, Research Methodology, Universities Press, Hyderabad, 2015.
3. G. Nageswara Rao, Research Methodology and Quantitative methods, BS Publications, Hyderabad, 2012.

Online Resources:

1. onlinecourses.nptel.ac.in

Course Outcomes

After completion of the course, students will be able to

1. Develop an understanding on various kinds of research and objectives of doing research.
2. Perform literature reviews using print and online databases.
3. Design good research.
4. Collect required data for Research and to adopt methods for data collection.
5. Interpret the data from research perception.
6. Write and present a substantial technical report and document.

III Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: OE116KP	**3**	**-**	**-**	**3**

DEPARTMENT OF HUMANITIES & MATHEMATICS

BEHAVIOURAL SKILLS AND PROFESSIONAL COMMUNICATION

(Open Elective-2)

Prerequisites:-Nil-

Course Objectives:

1. To achieve the desired life skills and social skills in their workplace.
2. To enable the students to handle and to overcome the professional challenges and conflicts in a working environment.
3. To facilitate the students to understand and develop their managerial skills in a professional environment.
4. To help the students understand professional and cross cultural communication through digital technologies.
5. To develop critical thinking skills for speech and writing.

UNIT 1: (~09 Lecture Hours)
Life Skills: Essentials of desirable social skills and presentability skills professionally-Confidence building-Self-esteem-Positive attitude-Assertiveness -Professional etiquette and manners -Johari Window.

UNIT 2: (~10 Lecture Hours)
Critical Thinking Skills: Decision Making - Problem Solving – Negotiation -Conflict resolution and Creative thinking – Blooms Taxonomy.

UNIT 3: (~10 Lecture Hours**)**
Managerial Skills: Time Management – Stress Management – Crisis Management – Conflict Management – Relationship Management.

UNIT 4: (~10 Lecture Hours**)**
Professional Skills: Digital Communication - Social Networking – Cross Cultural and Cross Functional Communication.

UNIT 5: (~09 Lecture Hours)
Human Values and Professional Ethics: Professional Codes of Ethics: Importance and Impact – Ethical Challenges and Conflicts – Moral Issues and dilemmas - Professional Etiquette and Netiquette.

Reference Books:

1. Meenakshi Raman and Shalini, Softskills: Key to success in workplace and life, Cengage Publications (2018).

2. Barun and K. Mitra, Personality Development and Soft Skills, 2nd Edition, Oxford University Press, (2016).
3. Sailesh Sen Gupta, Business and Managerial Communication, PH1 Learning Pvt. Ltd., (2011).

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_hs11/preview
2. https://onlinecourses.nptel.ac.in/noc19_mg03/preview
3. CEMCA – Life Skills for Engineers.

Course Outcomes:

After the completion of the course, the students will be able to

1. Communicate with more confidence and self-esteem.
2. Give better presentation and explanation using digital aids and tools.
3. Perform effectively and efficiently in the work place environment.
4. Exhibit better tolerance and receptiveness in understanding and accepting diversity.
5. Apply higher thinking order in the self-development process.
6. Equip oneself to handle the work related challenges and conflicts professionally.

IV Year B.Tech. I Semester	L	T	P	C
Course Code: OE117KR	3	-	-	3

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

CYBER SECURITY

(Open Elective-3)

Prerequisites:-Nil-

Course Objectives:

1. To demonstrate different types of Cybercrimes, Laws and IT Acts.
2. To introduce different types of Cyber Attacks and steps involved in planning Cybercrimes.
3. To explore various security challenges faced by mobile workforce and their implications under Cybercrime.
4. To introduce Proxy servers, Key loggers, SQL injections and wireless network hacking.
5. To determine various web threats faced by organizations and understand about Social Media Networking.

UNIT 1: (~9 Lecture Hours)
Introduction to Cybercrime: Introduction, Cybercrime – Definitions and origins of the word, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000 - Hacking and the Indian Law(s), A Global Perspective on Cybercrimes – Cybercrime and the Extended Enterprise.

UNIT 2: (~10 Lecture Hours)
Cyber Offenses: How Criminals Plan Them: Introduction – Categories of Cybercrime, How Criminals plan the Attacks – Reconnaissance, Passive Attacks, Active Attacks, Scanning and Scritinizing Gathered Information, Attack, Social Engineering, Cyber stalking – Types, Cases reported on Cyberstalking, Working of Stalking, Real-Life incident of Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT 3: (~9 Lecture Hours)
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 and Measures in Mobile Computing Era, Laptops.

UNIT 4: (~10 Lecture Hours)
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking – Online Attacks, Offline Attacks, Strong, Weak and Random Passwords, Keyloggers and Spywares – Software Keyloggers, Hardware Keyloggers, Antikeylogger, Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks – DoS Attacks, Classification, Types and Levels, Tools used to launch DoS attack, DDoS Attacks, How to protect from DoS/DDoS Attacks, SQL Injection, Buffer Overflow.

UNIT 5: (~10 Lecture Hours)
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 Books:
1. Nina Godbole and Sunil Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley INDIA.

Reference Books:
1. James Graham, Richard Howard and Ryan Otson, Cyber Security Essentials, CRC Press.
2. Chwan-Hwa (john) Wu and J.David Irwin, Introduction to Cyber Security, CRC Press T&F Group.

Online Resources:
1. https://www.open.edu/openlearn/futurelearn/cyber-security
2. https://www.cybrary.it/
3. https://www.cybersecurityeducation.org/resources/
4. https://www.onlinecourses.nptel.ac.in/
5. https://www/coursera.org/

Course Outcomes:
After completion of the course, students will be able to
1. Understand the evolution of Internet in the context of emerging Cyber threats and their laws.
2. Distinguish and classify the forms of Cybercriminal activities and Social Engineering methods used to undertake crimes.
3. Apply risk management policies to protect organization's critical information and assets.
4. Analyse the tools and methods used in Cybercrime.
5. Understand the Security challenges for mobile and wireless devices.
6. Assess the Cybercrime scenarios in India, Global and Legal Perspectives.

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Course Code: OE117KS	3	-	-	3

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

PYTHON PROGRAMMING

(Open Elective-3)

Prerequisites:-Nil-

Course Objectives:

1. To be able to introduce core programming basics and program design with functions using Python programming language.
2. To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
3. To understand the high-performance programs designed to strengthen the practical expertise.

UNIT 1: (~12 Lecture Hours)

Introduction to Python Programming: Using Python, The IDLE Programming Environment, Input and Output Processing, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations.

More about Data Output: New line, Item Separator, Escape Characters, Formatting parameters.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. **Repetition Structures:** Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops.

UNIT 2: (~9 Lecture Hours)

Functions: Introduction, Defining and Calling a Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions Generating Random Numbers, Writing Our Own Value-Returning Functions, The math Module, Random Module, Time Module and Storing Functions in Modules.

UNIT 3: (~10 Lecture Hours)

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples.

Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.
Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

UNIT 4: (~9 Lecture Hours)
Python File Input-Output: Opening and Closing file, various types of file modes, reading and writing to files, manipulating directories

Exception Handling: What is Exception, various keywords to handle exception- try, catch, except, else, finally, raise.

Regular Expressions: Concept of regular expression, various types of regular expressions, using match function.

UNIT 5: (~8 Lecture Hours)
GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Introduction to plotting in Python: Basic Plots- Line and Scatter Plot, Histograms and plotting data contained in files.

Text Books:
1. Tony Gaddis, Starting out with Python, 4th Edition, Pearson, 2017.
2. Kenneth A. Lambert, Fundamentals of Python, Delmar Cengage Learning, 2013.
3. Charles Dierbach, Introduction to Computer Science using Python, Wiley, 2013.

Reference Books:
1. James Payne, Beginning Python using Python 2.6 and Python 3, wrox programmer to programmer, 2010.
2. Paul Gries, Practical Programming: An Introduction to Computer Science using Python, 3rd Edition, 2016.
3. Clinton W. Brownley, Foundations for Analytics with Python", 1st Edition, O'Rielly Media, 2016.

Online Resources:
1. https://www.python.org/
2. https://www.coursera.org/learn/python
3. https://learnpythonthehardway.org/book/
4. https://www.coursera.org/specializations/python

5. https://www.learnpython.org/
6. https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Gain knowledge on the basic principles of Python programming language.
2. Understand different Decision Making statements and Functions.
3. Apply the knowledge of data structures like Lists, Dictionaries and sets.
4. Understand and summarize different File and exception handling operations.
5. Implement object oriented concepts.
6. Design GUI applications using Python.

IV Year B. Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: OE117KT	**3**	**-**	**-**	**3**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

ANDROID PROGRAMMING

(Open Elective-3)

Prerequisites:-Nil-

Course Objectives:

1. To demonstrate their understanding of the fundamentals of Android operating systems.
2. To demonstrate their skills of using Android software development tools.
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform.
4. To demonstrate their ability to deploy software to mobile devices.
5. To demonstrate their ability to debug programs running on mobile devices.

UNIT 1: (~9 Lecture Hours)

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools.

Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc., Resources for different devices and languages, Runtime Configuration Changes.

Android Application Lifecycle– Activities, Activity lifecycle, activity states, monitoring state changes.

UNIT 2: (~9 Lecture Hours)

Android User Interface: Measurements – Device and pixel density independent measuring units.

Layouts – Linear, Relative, Grid and Table Layouts.

User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers.

Event Handling – Handling clicks or changes of various UI components.

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing

fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

UNIT 3: (~9 Lecture Hours)
Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS.

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity.

Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT 4: (~9 Lecture Hours)
Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference.

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers. (insert, delete, retrieve and update)

UNIT 5: (~9 Lecture Hours)
Advanced Topics: Alarms – Creating and using alarms.
Using Internet Resources – Connecting to internet resource, using download manager.

Location Based Services – Finding Current Location and showing location on the Map, updating location.

Text Books:

1. Reto Meier, Professional Android 4 Application Development, Wiley India, (Wrox), John Wiley & Sons, Inc, 4th Edition, 2012,.
2. James C Sheusi, Android Application Development for Java Programmers, Cengage Learning, Course Technology, a part of Cengage Learning, 2013.

Reference Books:

1. Wei-Meng Lee, Beginning Android 4 Application Development, 4th Edition, Wiley India (Wrox), 2013.

Online Resources:

1. https://developer.android.com/guide
2. https://www.tutorialspoint.com/android/
3. https://developer.android.com/studio
4. https://nptel.ac.in/courses/106106147/6
5. https://in.udacity.com/course/new-android-fundamentals—ud851
6. https://medium.com/@tristaljing/10-best-app-development-courses-for-beginners-and-get-a-job-d84dbf34b101

Course Outcomes:

At the end of the course the students are able to

1. Describe Android platform, Architecture and features.
2. Design User Interface and develop activity for Android App.
3. Use Intent, Broadcast receivers and Internet services in Android App.
4. Design and implement Database Application and Content providers.
5. Use multimedia, camera and Location based services in Android App.
6. Discuss various security issues in Android platform.

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Course Code: OE117KU	3	-	-	3

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING/
DEPARTMENT OF ELECTRONICS AND TELEMATICS ENGINEERING

TELECOMMUNICATION SWITCHING SYSTEMS

(Open Elective-3)

Prerequisites:-Nil-

Course Objectives:

1. To expose through the evolution of switching systems from electromechanical systems to stored-program-controlled digital systems.
2. To provide knowledge to the students regarding design and performance analysis of electronic space division switching systems.
3. To provide knowledge to the students regarding design and performance analysis of time division switching systems.
4. To train the students about basic concepts of Telephone Networks.
5. To inculcate students on various traffic engineering concepts.

UNIT 1: (~10 Lecture Hours)
Telecommunication Switching Systems: Introduction, Evolution of Telecommunications, Basics of a switching system, Crossbar Switching, Principles of Crossbar Switching, Crossbar Switch Configuration, Crosspoint Technology, Crossbar Exchange Organization.

UNIT 2: (~8 Lecture Hours)
Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced services, Two-Stage Networks, Three-Stage Networks, n-Stage Networks.

UNIT 3: (~8 Lecture Hours)
Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching, Three Stage Combination Switching, n - Stage Combinational Switching.

UNIT 4: (~10 Lecture Hours)
Telecommunications Traffic : Introduction, The Unit of Traffic, Congestion, Traffic Measurement, A Mathematical Model, Lost-Call Systems- Theory, Traffic Performance, Loss Systems in Tandem, Use of Traffic Tables, Queuing Systems-The Second Erlang Distribution, Probability of Delay.

UNIT 5: (~10 Lecture Hours)

Telephone Networks : Subscriber loop systems, Switching hierarchy and routing, Transmission plan, Transmission systems, Numbering plan, Charging plan, Signaling techniques: In channel signaling, Common channel signaling.

Text Books:

1. Thyagarajan Viswanathan, Tele Communication Switching System and Networks, PHI, 2000.
2. J. E Flood, Telecommunications Switching and Traffic Networks, Pearson Education, 2006.

Reference Books:

1. J. Bellamy, John Wiley, Digital telephony, 2nd Edition, 2001.
2. Achyut. S.Godbole, Data Communications & Networks, TMH, 2004.
3. H. Taub & D. Schilling, Principles of Communication Systems, TMH, 2nd Edition, 2003.
4. S.Keshav, An Engineering approach to computer networking, Addison Wesely.

Online Resources:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/0471208051
2. https://en.wikipedia.org/wiki/Telecommunication

Course Outcomes:

At the end of the course, the students will be able to

1. Acquire knowledge about Telecommunication Switching Systems.
2. Understand different Telecommunication switching and signaling methodologies.
3. Apply the concepts to solve the real time telecommunication problems.
4. Analyse the fundamental telecommunication traffic models.
5. Evaluate telecommunication switching systems.
6. Design a telecommunication switching system.

IV Year B.Tech. I-Semester **L T P C**
Course Code: OE117KV **3 - - 3**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

WASTE MANAGEMENT TECHNIQUES AND POWER GENERATION

(Open Elective-3)

Prerequisites:-Nil-

Course Objectives:

1. To classify the sources of solid waste & e-waste.
2. To identify methods of solid waste disposal.
3. To understand various waste management techniques.
4. To study various energy generation methods as per type of waste available locally.
5. To analyze energy generation methods and recycling of waste.

UNIT 1: (~8 Lecture Hours)

Waste Management and Handling: Sources & types of wastes (Industrial, Municipal, Agro, Domestic). Generation of wastes, Pollution standards, Waste characterization. Functional elements of waste management, technological aspects related to waste generation, on site handling, storage, collection, transfer and transport.

Processing techniques and equipment (volume reduction, size reduction, component separation, dewatering, drying).

UNIT 2: (~8 Lecture Hours)

Waste Management Issues: Planning, organization & control Hazardous & toxic wastes, hazard & its management, classification, generation, handling, processing and disposal. Industrial safety, Waste disposal, Environmental impact (toxic & non-toxic).

UNIT 3: (~10 Lecture Hours)

Conversion Techniques & Methods: Recovery of value added components: Recycling, conversion products and energy Conversion technologies: Incineration,-principle features of an incinerator -site selection and plant layout of an incinerator - Thermo-chemical conversions. Biochemical conversion: Biogas & ethanol Conventional Chemical & biological treatment. Power generation & its utilization.

UNIT 4: (~ 08 Lecture Hours)

Processing Techniques and Recovery of Energy: Processing techniques

– purposes mechanical volume reduction-necessary equipments – chemical volume reduction-mechanical size reduction selection of equipments-components separation-methods-drying and dewatering. Refusal disposal – various methods.

UNIT 5: (~10 Lecture Hours)

Concepts of Land Fill & e-Waste

Concepts of Land Fill: Land Fill method of solid waste disposal, Land fill classification, Types, methods and Sitting consideration, Layout and preliminary design of landfills: Composition, Movement and control of landfill leachate and gases, Environmental monitoring for land fill gases.

e-Waste: e-waste in global context, Environmental concerns, Global trading in hazardous waste, Management of e-waste, e-waste legislation, Government regulations on e-waste management & Recycling.

Text Books:

1. T.V. Ramachandra, Management of Municipal Solid Waste, The Energy and Resources Institute, TERI, 2009.
2. Thomas Christensen, Solid waste technology and Management, 2nd Volume Set., WILEY Publishers, 2011.
3. K.Sasi Kumar and Sanoop Gopi Krishna, Solid Waste Management, PHI Learning Pvt. Ltd, 2009.

Reference Books:

1. Vasudevan Rajaram, Faisal Zia Siddiqui, Sanjeev Agrawal and Mohammad Emran Khan, Solid and Liquid Waste Management: Waste to Wealth, PHI Learning Pvt. Ltd, 2016.
2. P.Jayarama Reddy, Energy Recovery from Municipal Solid Waste by Thermal Conversion Technologies, CRC Press, 2016.
3. Ms Bhatt Asheref Illiyan, Solid waste Management: An Indian Perspective, Synergy Books India, 2012.

Course Outcomes:

Upon the completion of the course, the students will be able to

1. Understand technologies for generation of energy from solid waste.
2. Compare methods of solid waste disposal.
3. Identify sources of energy from waste using various conversion techniques.
4. Analyze methods for waste management.
5. Assess the harmful effects of e-waste.
6. Differentiate between the normal waste and e-waste.

IV Year B.Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: OE117KW	**3**	**-**	**-**	**3**

DEPARTMENT OF HUMANITIES & MATHEMATICS

INDUSTRIAL MANAGEMENT

(Open Elective-3)

Prerequisites:-Nil-

Course Objectives:

1. To up skill the importance of Productivity in Production Process.
2. To give insights of managing Production activities.
3. To sensitize the importance of Quality.

UNIT 1: (~ 08 Lecture Hours)

Introduction to Industrial Management

Industrial Management – Introduction - Need, Scope, Evolution – Industrial Engineering and Management.

Production Management – Plant location – Factors affecting Plant location - Plant Layout – Types of Plant Layout – Product, Process, Fixed Position and Combination Layout.

UNIT 2: (~07 Lecture Hours)

Production and Productivity

Production – Introduction – Types of Production – Job, Batch and Mass Production – Methods of Production.

Productivity – Concept of Productivity – Production vs Productivity – Objectives – Factors affecting Productivity – Kinds of Productivity – Material, Labour, Capital, Machine and general measure of Productivity (Theory only) – Measures to improve Productivity and its benefits.

UNIT 3: (~10 Lecture Hours)

Operations and Materials Management

Operations Management – Work study – Introduction – Objectives – Scope of Work study- Method study - Definition - Objectives – Steps of Method study. Work measurement – Definition, objectives and benefits of Work measurements – Time study – Definition – Steps in Time study – Uses of Time study.

Materials Management-Definition- Objectives-Functions-Purchase procedure-ABC analysis -VED Analysis – Economic Order Quantity.

UNIT 4: (~ 10 Lecture Hours)

Inventory and Stores Management

Inventory Management – Introduction - Functions of Inventory Control – Advantages of Inventory Control – Methods of Inventory issues – FIFO,

LIFO, Simple average and Weighted average methods (simple problems) – Material Resource Planning (MRP) - Enterprise Resource Planning (ERP) – Just in Time (JIT) - Supply Chain Management (SCM)

Stores Management – Stores Keeping – Classification of Stores – Stores Records

UNIT 5: (~10 Lecture Hours)

Quality Management and Control

Quality Management – Introduction, Evolution, Contributions of Juran, Deming, Crosby, Total Quality Management.

Statistical Quality Control -Advantages of Quality control-Shewart Control Charts for variables - $\bar{X}$ chart and R chart-Attributes-Defective – Defect-Charts for Attributes -P Chart and C Chart (simple problems)-Six Sigma.

Text Books:

1. O.P. Khanna, Industrial Engineering and Management, Dhanpat Rai Publications Pvt. Ltd., 2004.
2. T.R. Banga, NK Agarwal and S.C. Sarma, Industrial Engineering and Management Science, 10th Edition, Khanna Publishers, 2005.

Reference Books:

1. Joseph and G. Monks, Operations Management (Theory and Problems), Mc. Graw- Hill Series in Management, 3rd Edition, 1987.
2. NVS Raju, Industrial Engineering & Management, Cengage Learning, 2013.
3. Besterfield H. Dale, Total Quality Management, 3rd Edition, Pearson, 2003.

Online Resources:

1. Operations Management
   https://onlinecourses.nptel.ac.in/noc18_me26/preview

Course Outcomes:

After completion of the course the student will be able to

1. Organize the activities of Business efficiently.
2. Adapt to appropriate method of production yielding productivity.
3. Identify efficient method of production.
4. Handle inventory efficiently for improving Productivity.
5. Implement and maintain Quality standards in Production.
6. Cohere to dynamic practices to improve Productivity.

IV Year B.Tech. II-Semester **L T P C**
Course Code: OE118KX **3 - - 3**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

PRINCIPLES OF ARTIFICIAL INTELLIGENCE

(Open Elective-4)

Prerequisites:-Nil-

Course Objectives:

1. To learn the difference between optimal reasoning vs human like reasoning.
2. To understand the notions of state space representation, uninformed search, informed (heuristic) search.
3. To learn different knowledge representation techniques.
4. To understand the applications of Al: namely Game Playing, Expert Systems, Machine Learning and Natural Language Processing.

UNIT 1: (~11 Lecture Hours)
Introduction: History, Foundations of AI, Sub areas of AI, Objectives and Applications of AI.

Intelligent Agent: Agents and Environments and the Structure of Agents. **Solving Problem by Searching:** Introduction, General Problem Solving. **Uninformed Search Strategies:** Breadth First Search and Depth First Search. **Informed (Heuristic) Search Strategies:** Heuristic Function, A* Algorithm and Hill Climbing.

UNIT 2: (~10 Lecture Hours)
Game Playing: Optimal Decisions in Games, the Minimax Algorithm, Alpha-Beta Pruning, Constraint Satisfaction Algorithm.

Logic Concepts: Introduction, Propositional Logic, Predicate Logic, Unification Algorithm, Natural Deduction System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic.

UNIT 3: (~10 Lecture Hours)
Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Networks and Extended Semantic Networks, Knowledge Representation using Frames.

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Application of Expert Systems, List of Shells and Tools.

UNIT 4: (~9 Lecture Hours)

Uncertainty Measure – Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Dempster-Shafer Theory.

Machine Learning: Introduction. Machine Learning Systems. Supervised, Unsupervised Learning and Reinforcement Learning, Learning Decision Trees, Clustering, Support Vector Machines.

UNIT 5: (~8 Lecture Hours)

Artificial Neural Networks: Introduction, Artificial Neural Networks, Single- Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks, Recurrent Networks, Design Issues of Artificial Neural Networks.

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web.

Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers.

Text Books:

1. Russell and Norvig, Artificial intelligence, A Modern Approach, Pearson Education, 3rd Edition. 2014.
2. Rich, Knight and Nair, Artificial intelligence, Tata McGraw Hill, 3rd Edition 2009.

Reference Books:

1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw-Hill Education, 2013
2. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011D, Samanta, Classic Data Structures, 2nd Edition, PHI.

Online Resources:

1. https://faculty.psau.edu.sa/filedownload/doc-7-pdf a154ffbcec 538a4161a406abf62f5b76-original.pdf
2. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf
3. http://nptel.ac.in/courses/106105077/
4. https://onlinecourses.nptel.ac.in/noc18_cs18/preview
5. https://www.edx.org/course/artificial-intelligence-ai-columbiax-csmm-101x-4

Course Outcomes:

After completion of the course, students will be able to

1. Understand the basics of AI and knowledge representation using appropriate technique.

2. Apply AI techniques for problem solving using various search and game Playing algorithms.
3. Interpret architectures of different intelligent agents and Expert Systems.
4. Interpret probabilistic and logical reasoning for knowledge.
5. Analyse different Machine Learning approaches for problem solving.
6. Recognize basics of Natural Language Processing.

IV Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: OE118KY	**3**	**-**	**-**	**3**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING/
DEPARTMENT OF INFORMATION TECHNOLOGY

CLOUD COMPUTING

(Open Elective-4)

Prerequisites:-Nil-

Course Objectives:

1. To explain evolving computer model called cloud computing.
2. To introduce the various levels of services that can be achieved by cloud.
3. To describe the security aspects of cloud.

UNIT 1: (~9 Lecture Hours)
Introduction: Cloud computing at a glance, Historical developments, Building cloud computing environments.
Cloud Computing Architecture: The cloud reference model, Types of clouds, Economics of the cloud, Open challenges.

UNIT 2: (~9 Lecture Hours)
Virtualization: Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples- Xen, VMware, Microsoft Hyper-V. Migrating into a Cloud, Virtual Machines Provisioning and Migration Services.

UNIT 3: (~9 Lecture Hours)
Cloud Platforms in Industry: Amazon web services, Google AppEngine, Microsoft Azure, Aneka-Integration of private and public cloud
Cloud Applications: Scientific applications, Business and consumer applications.

UNIT 4: (~9 Lecture Hours)
Security in the Cloud: Cloud Security Challenges, Software-as-a-Service Security.
Secure Distributed Data Storage in Cloud Computing: Cloud Storage: from LANs to WANs, Technologies for Data Security in Cloud Computing.
Data Security in the Cloud: The Current State of Data Security in the Cloud, Cloud Computing and Data Security Risk, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security, Content Level Security-Pros and Cons.

UNIT 5: (~9 Lecture Hours)
SLA Management: Traditional Approaches to SLO Management, Types

of SLA, Life Cycle of SLA, SLA Management in Cloud, Automated Policy-based Management.

Common Standards in Cloud Computing: The Open Cloud Consortium, Distributed Management Task Force, Standards for Application Developers, Standards for Messaging, Standards for Security.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill Education 2013.
2. Rajkumar Buyya, James Broberg, Andrzej and Wiley, Cloud Computing: Principles and paradigms, 2011.
3. John W. Rittinghouse and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC, 2010.

Reference Books:

1. Kai Hwang, Geoffery C.Fox and Jack J Dongarra, Distributed and cloud computing, Elsevier, 2012.
2. A. Kannammal, Fundamentals of Cloud Computing, CL India, 2015.
3. Tim Mather, Subra Kumaraswamy and Shahed Latif, Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance. Publisher: O'Reilly Media 2009.

Online Resources:

1. https://ramslaw.files.wordpress.com/2016/07/0124114547cloud.pdf
2. http://www.chinacloud.cn/upload/2011-07/11073107539898.pdf
3. https://eniac2017.files.wordpress.com/2017/03/distributed-and-cloud- computing.pdf
4. https://aws.amazon.com/
5. https://cloud.google.com/
6. https:// onlinecourses.nptel.ac.in
7. https://coursera.org/learn/cloud-computing

Course Outcomes:

After completion of the course, students will be able to

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing.
2. Illustrate the broad perceptive of cloud architecture and model.
3. Apply and design suitable Virtualization concept.
4. Explore some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services and other businesses cloud applications.
5. Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application.
6. Analyse the various standards for Cloud computing and its management.

IV Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: OE118KZ	**3**	**-**	**-**	**3**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING/
DEPARTMENT OF ELECTRONICS AND TELEMATICS ENGINEERING

CELLULAR AND MOBILE COMMUNICATIONS

(Open Elective-4)

Prerequisite:-Nil-

Course Objectives:

1. To provide the student with an understanding of the Cellular concept, Frequency reuse, Hand-off strategies.
2. To enable the student to analyze and understand wireless and mobile cellular communication systems over a stochastic fading channel.
3. To provide the student with an understanding of Co-channel and Non-Co-channel interferences.
4. To give the student an understanding of cell coverage for signal and traffic, diversity techniques and mobile antennas.
5. To give the student an understanding of frequency management, Channel assignment and types of handoff.

UNIT 1: (~12 Lecture Hours)

Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems, Uniqueness of Mobile Radio Environment- Fading - Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni Directional Antenna System, System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.

UNIT 2: (~11 Lecture Hours)

Co-Channel Interference: Measurement Of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and Their Effects, Diversity Techniques-Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity**.**

Non-Co-Channel Interference: Adjacent Channel Interference, Near End

Far End Interference, Cross Talk, Effects on Coverage and Interference by Power Decrease, Antenna Height Decrease, Effects of Cell Site Components.

UNIT 3: (~11 Lecture Hours)
Cell Coverage for Signal and Traffic: Signal Reflections in Flat And Hilly Terrain, Effect of Human Made Structures, Phase Difference Between Direct and Reflected Paths, Constant Standard Deviation, Straight Line Path Loss Slope, General Formula for Mobile Propagation Over Water and Flat Open Area, Near and Long Distance Propagation, Path Loss From a Point to Point Prediction Model in Different Conditions, Merits of Lee Model. **Cell Site and Mobile Antennas:** Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas**.**

UNIT 4: (~7 Lecture Hours)
Frequency Management and Channel Assignment: Numbering And Grouping, Setup Access And Paging Channels, Channel Assignments to Cell Sites and Mobile Units, Channel Sharing and Borrowing, Sectorization, Overlaid Cells, Non Fixed Channel Assignment**.**

UNIT 5: (~7 Lecture Hours)
Handoffs and Dropped Calls: Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem Handoff, Introduction to Dropped Call Rates and their Evaluation

Text Books:

1. W.C.Y. Lee, Mobile Cellular Telecommunications, 2nd Edition, McGraw Hill, 1989.
2. Theodore. S. Rapport, Wireless Communications, 2nd Edition, Pearson Education, 2002.
3. Upena Dalal, Wireless communication and networks, Oxford University press.

Reference Books:

1. Gordon L. Stuber, Principles of Mobile Communications, 2nd Edition, Springer International, 2001.
2. Simon Haykin and Michael Moher, Modern Wireless Communications, Pearson Education, 2005.
3. Asrar U. H. Sheikh, Wireless Communications Theory and Techniques, Springer, 2004.

4. Vijay Garg, Wireless Communications and Networking, Elsevier Publications, 2007.
5. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc17_cs37/preview Wireless and Cellular Communication by Prof.R. David Koilpillai.
2. https://nptel.ac.in/courses/117102062/ : Wireless Communication by Dr. Ranjan Bose

Course Outcomes:

After completion of the course the student will be able to

1. Analyze and design wireless and mobile cellular systems.
2. Understand impairments due to multipath fading channel.
3. Understand the fundamental techniques to overcome the different fading effects.
4. Understand Co-channel and Non Co-channel interferences.
5. Familiar with cell coverage for signal and traffic, diversity techniques and mobile antennas.
6. Understanding of frequency management, Channel assignment, and types of handoff.

IV Year B.Tech. II-Semester	L	T	P	C
Course Code: OE118MA	3	-	-	3

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ROBOTICS

(Open Elective-4)

Prerequisites:-Nil-

Course Objectives:

1. To understand basic concepts of robotics.
2. To learn various sensors and actuators used in the design of robots.
3. To learn various robot programming methods and languages.

UNIT 1: (~8 Lecture Hours)

Introduction: - Basic Concepts such as Definition, brief history, three laws, depth of filed, Robot anatomy, Classification and usage, science and technology of robots, associated parameters: resolution, accuracy, repeatability, dexterity.

UNIT 2: (~8 Lecture Hours)

Sensors for Robots: - Characteristics of sensing devices, Selections of sensors, Classification and applications of sensors. Types of Sensors, Need for sensors and vision system in the working and control of a robot.

Drives: - Types of Drives, Actuators and its selection while designing a robot system. Types of transmission systems

UNIT 3: (~10 Lecture Hours)

Control Systems: - Types of Controllers, Introduction to closed loop control, second order linear systems and their control, control law partitioning, trajectory-following control, modelling and control of a single joint, present industrial robot control systems and introduction to force control

Machine Vision System: - Vision System Devices, Image acquisition, Masking, Sampling and quantisation, Image Processing Techniques, Noise reduction methods, Edge detection, Segmentation

UNIT 4: (~9 Lecture Hours)

Robot Programming: Methods of robot programming, lead through programming, motion interpolation, branching capabilities, WAIT, SIGNAL and DELAY commands, subroutines,

Programming Languages: Introduction to various types such as RAIL and VAL II …etc., Features of each type and development of languages for recent robot systems

UNIT 5: (~8 Lecture Hours)
Associated Topics in Robotics: - Socio-Economic aspect of robotisation, Economical aspects for robot design, Safety for robot and associated mass, New Trends & recent updates in robotics, International Scenario for implementing robots in Industrial and other sectors. Future scope for robotisation.

Text Books:

1. John J. Craig, Introduction to Robotics (Mechanics and Control), 2nd Edition, Addison-Wesley, 2004.
2. Mikell P. Groover et. al., Industrial Robotics: Technology, Programming and Applications, McGraw – Hill International, 1986.
3. Richard D. Klafter, Thomas A. Chemielewski, Michael Negin, Robotic Engineering: An Integrated Approach, Prentice Hall India, 2002.

Reference Books:

1. K.S. Fu, R.C. Gonzales, C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw Hill, 1987.
2. Shimon Y. Nof, Handbook of Industrial Robotics, John Wiley Co, 2001.

Course Outcomes:

After completion of the course, students will be able to

1. Identify a Robot for a specific application.
2. Identify parameters required to be controlled in a Robot.
3. To select suitable sensors and drive system for an application
4. To learn various robot programming methods and languages
5. To learn various industrial robot control systems and Mission Vision system
6. To understand Socio-Economic aspect of robotisation.

IV Year B.Tech. II-Semester	L	T	P	C
Course Code: OE118MB	3	-	-	3

DEPARTMENT OF HUMANITIES & MATHEMATICS

MARKETING MANAGEMENT

(Open Elective- 4)

Prerequisites:-Nil-

Course Objectives:

1. To orient the importance of Marketing in Product delivery.
2. To understand buyer behavior in Product selection.
3. To give overview of Marketing Mix in Product delivery.

UNIT 1: (~8 Lecture Hours)

Introduction to Marketing Management

Marketing Management: Meaning and importance – Nature & Scope – Core concepts including Marketing Mix and Marketing Research – Evolution of Marketing concepts from Production concept to Societal Marketing concept – Green Marketing – Marketing Process.

UNIT 2: (~10 Lecture Hours)

Market Segmentation & Buyer Behavior

Market Segmentation: Levels & Patterns of Market Segmentation – Segmentation of Consumer & Business Markets –Target Marketing – Developing and communicating a positioning strategy – Differential Tools - New Product Development and its process.

Buyer Behavior: Importance of Buyer behavior -Factors influencing buyer behavior – Cultural – Social – Personal & Psychological – Buying decision process - stages of buying decision process.

UNIT 3: (~10 Lecture Hours)

Product Offerings and Pricing Strategies

Product Offering: The Product and Product Mix – Product Line decisions – Brand Decisions – Packaging and Labeling.

Pricing Strategies: - Setting the Price - Adapting the Price – Initiating and Responding the Price changes.

UNIT 4: (~9 Lecture Hours)

Managing Marketing Channels through Networks

Distribution: Distribution Channels and Value Network-Channel Intermediaries-Channel Structure-Decision and Functions-Channel Dynamics-Retailing-Types-Wholesaling-Market Logistics.

UNIT 5: (~ 9 Lecture Hours)

Promotion:- Nature and Importance of Promotions – Designing and Managing Promotion Mix – Managing Advertising – Sales Promotion - Personal Selling – Public Relation – Direct Marketing – Publicity and Social Media – Managing Digital Communication – E-Marketing , M-Marketing, Services Marketing.

Text Books:

1. Philip Kotler, Marketing Management, 11th Edition, Prentice-Hall of India Pvt Ltd, 2003.
2. Philip Kotler and Kevin Lane Keller, Marketing Management, 15th Edition, Pearson, 2016.

Reference Books:

1. Rajagopal, Marketing – Concept and Cases, New Age International (P) Ltd., 2008
2. NVS Raju, Industrial Engineering & Management, Cengage Learning, 2013.
3. Richard J.Semenik, Promotion & Integrated Marketing Communication, Thomson South-Western, 2006.

Online Resources:

Marketing Management:

1. https://nptel.ac.in/courses/110104068/
2. https://nptel.ac.in/courses/110104070/

Course Outcomes:

After completion of the course the student will be able to

1. Understand the importance of the Marketing Management Process
2. Conduct Marketing Research, comprehend buyer behavior and hypothesize market segmentation.
3. Identify the elements of product mix and pricing strategies.
4. Enumerate strategies of pricing in fixation.
5. Select appropriate network of product distribution.
6. Adapt to befitting promotional strategy.

IV Year B.Tech. II-Semester	L	T	P	C
Course Code: OE118MC	3	-	-	3

DEPARTMENT OF BASIC SCIENCES

ENVIRONMENTAL IMPACT ASSESSMENT

(Open Elective-4)

Prerequisites:-Nil-

Course Objectives:

1. To provide knowledge on various aspects of Environment Impact Assessment Methodologies.
2. To understand the impact of development activities on water, air and biological Environment.
3. To prepare the Environmental Impact Statement (EIS) and Environmental Audit (EA) Report.
4. To provide knowledge about Environmental Legislations and ISO 14000 standards pertaining to Environmental Management.

UNIT 1: (~9 Lecture Hours)

Basic Concepts of EIA: Definition of Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS)**,** Initial environmental examination, Elements of EIA, Stages in EIA, factors affecting EIA, Classification of environmental parameters, Impact analysis. Preparation of Environmental Base map.

EIA Methodologies: Introduction, Criteria for the selection of EIA Methodology, EIA methods- Adhoc method, Matrix method, Network method, Environmental Media Quality Index method and Overlay methods. Cost Benefit Analysis.

UNIT 2: (~9 Lecture Hours)

Assessment of Impact of Development Activities: Deforestation – causes, effects and control measures, impact on Vegetation and Wildlife. Review of Environmental Impact Assessment, guidelines for preparation of Environmental Impact Statement. Environmental Impact Mitigation measures.

UNIT 3: (~8 Lecture Hours)

Procurement of Relevant Soil Quality: Soil – types and quality, impact prediction of soil quality due to human developmental activities, impact assessment and its significance. Identification and incorporation of mitigation measures.

UNIT 4: (~9 Lecture Hours)

Environmental Audit: Objectives of Environmental Audit, types of Environmental Audit, Audit protocol. Stages of Environmental Audit - onsite activities, evaluation of audit data and preparation of Audit report, Post Audit activities.

UNIT 5: (~9 Lecture Hours)

Environmental Legislations: Objectives of Environmental Legislations, The Environmental (Protection) Act 1986, The Water (Prevention and Control of Pollution) Act 1974, The Air (Prevention and Control of Pollution) Act 1981, The Motor Act 1988, The Wild life (Protection) Act 1972. Concept of ISO and ISO 14000, Case studies and preparation of Environmental Impact Statement for various Industries.

Text Books:

1. Larry Canter, Environmental Impact Assessment, McGraw-Hill Publications, 1996.
2. R.R Barthwal, Environmental Impact Assessment, New Age International Publications, 2010.
3. Environmental Impact Assessment: Theory & Practice, P. Wathern Publishers Rutledge, London, 1992

Reference Books:

1. R.K. Khitoliya, Environmental Pollution, S. Chand Publishing, 2014.
2. J. Glynn and W. H. Gary, Environmental Science and Engineering, Prentice Hall Publishers, 1996.
3. Suresh K. Dhameja, Environmental Science and Engineering, S.K. Kataria and Sons Publication, New Delhi, 2006.
4. H. S. Bhatia, Environmental Pollution and Control, Galgotia Publication Private Limited, Delhi, 2003.
5. M.Anji Reddy, Environmental Impact Assessment, BSP Books Private Limited, 2017.

Online Resources:

1. Environmental Impact Assessment-Open Educational Resource http://www.raymondsumouniversity.com/eia-local/about.html
2. Environmental Impact Assessment - https://unep.ch/etb/publications/enviImpAsse.php
3. Urban Environmental Management - http://www.gdrc.org/uem/eia/impactassess.html
4. Environmental Impact Assessment Report https://www.miga.org/sites/default/files/archive/Documents/EIA_Rwanda_Stones.pdf

5. https://cept.ac.in/cce/admin/images/files/1347949702_po7tf.pdf
6. https://www.iisd.org/learning/eia/
7. https://www.iaia.org/iaia-training-courses.php
8. https://www.eiatraining.com/index.html

Course Outcomes:

After completion of the course, students will be able to

1. Understand the basic concepts of Environmental Impact Assessment, Environmental Impact Statement and Environmental Audit.
2. Identify the environmental aspects to be considered for the Environmental Impact Assessment study.
3. Apply the knowledge of Environmental Impact Assessment studies in Preparation of Environmental Impact Statement.
4. Prepare suitable methodology in Environmental Impact Assessment documentation.
5. Analyse and evaluate the mitigation measures of developmental activities on environmental components.

Program Outcomes

Engineering knowledge Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

Problem analysis Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions uing first principles of mathematics, natural sciences and engineering sciences.

Design/development of solutions Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems Use research – based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

Modern tool usage Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The engineer and society Apply reasoning informed by the contextual knowledge to asses societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability Understand the impact of the professional enginnering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

Ethics
Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work Function effictively as an individual and as a member or leader in diverse teams and in mulitidisciplinary settings.

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (For Women)
(AUTONOMOUS)

INSTITUTE VISION

To become a center of quality education in Engineering and Technology for women empowerment.

INSTITUTE MISSION

- To fulfill the academic aspirations of women engineers for enhancing their intellectual capabilities and technical competency.
- To Leverage Leading – Edge Technologies and cultivate exemplary work culture.
- To facilitate success in their desired career in the field of engineering to build a progressive nation.

INSTITUTE QUALITY POLICY

G. Narayanamma Institute of Technology and Science (For Women), Hyderabad is committed in imparting Quality Education and Training for women empowerment in the field of "Engineering and Technology" and to satisfy applicable requirements through continual improvement of the Quality Management System by facilitating and supporting the staff and students to work as a team in upgrading their knowledge and skill in tune with the industrial and technological developments through a set of Quality objectives.